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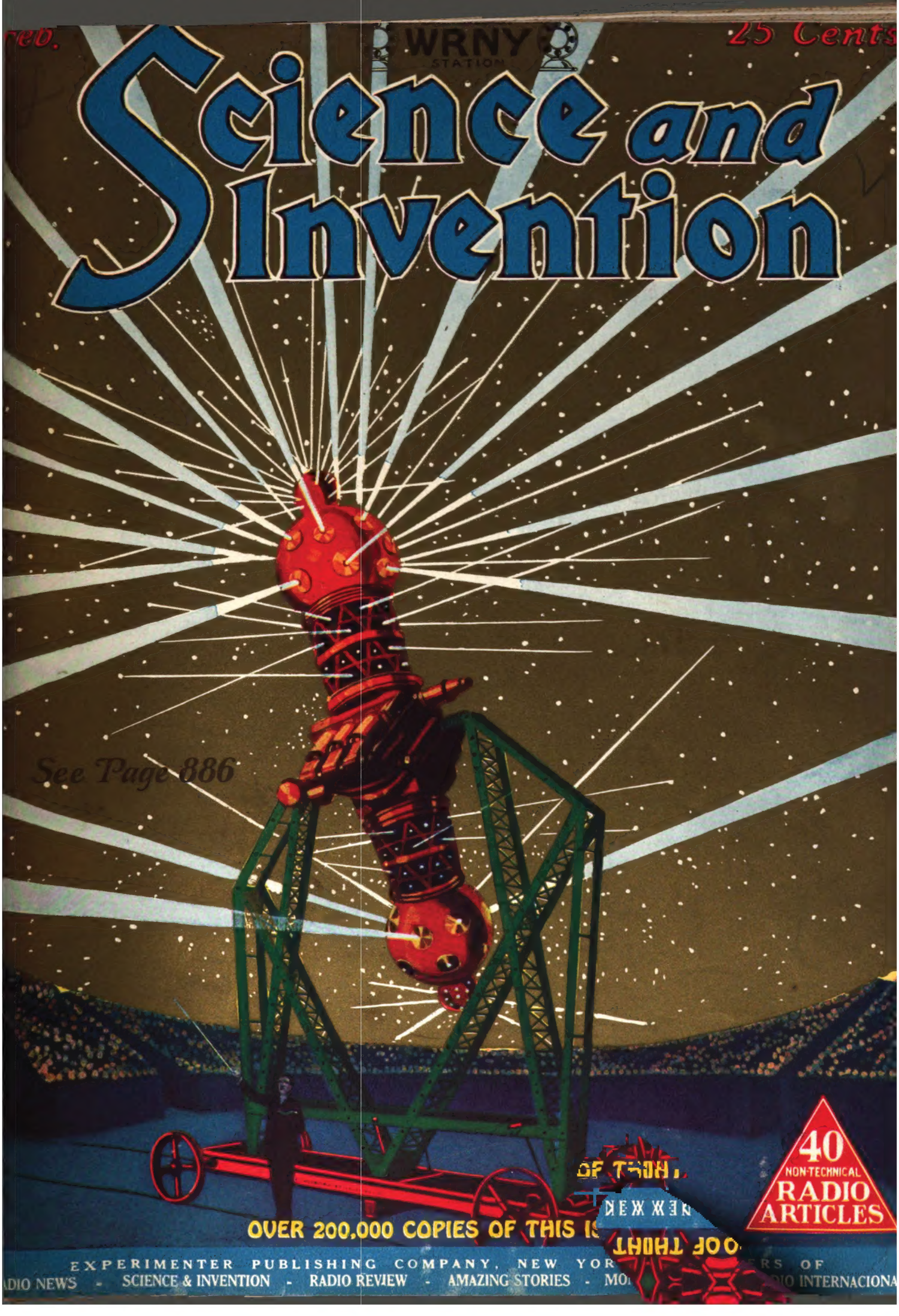

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Single Dial Radio

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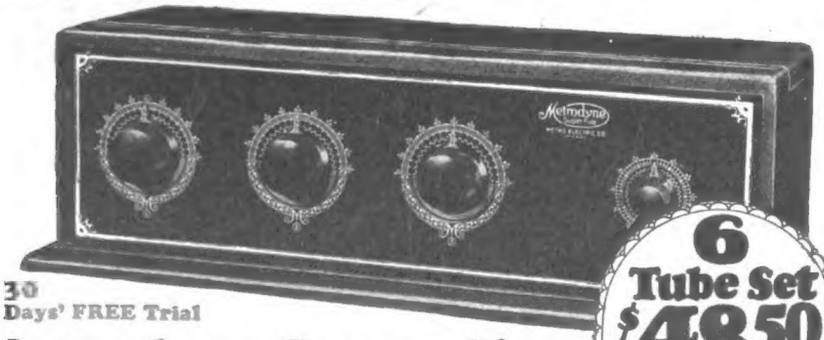

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Science and Invention

Vol. XIV
Whole No.
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Seeing Over a Wire!

While a new American system seems to give promise of solving the gigantic problem of Television or "seeing over a wire," a new European system seems equally full of promise. Read all about it in the March number in diagram and picture.

Science Makes Women Beautiful

The real science behind the latest efforts of the beauty doctors to make milady beautiful.

Aerial Firefighters!

Read all about the very latest firefighting equipment comprising an ingenious crewless aircraft for fighting skyscraper and other high building fires.

Canals of Mars

Mr. Donald P. Beard gives us an interesting resumé of the latest discoveries regarding the canals of Mars and the possibility of its being inhabited.

An A-B-C Eliminator

Mr. A. P. Peck explains in picture, diagram and text how to build an A-B-C eliminator for operating your radio set.

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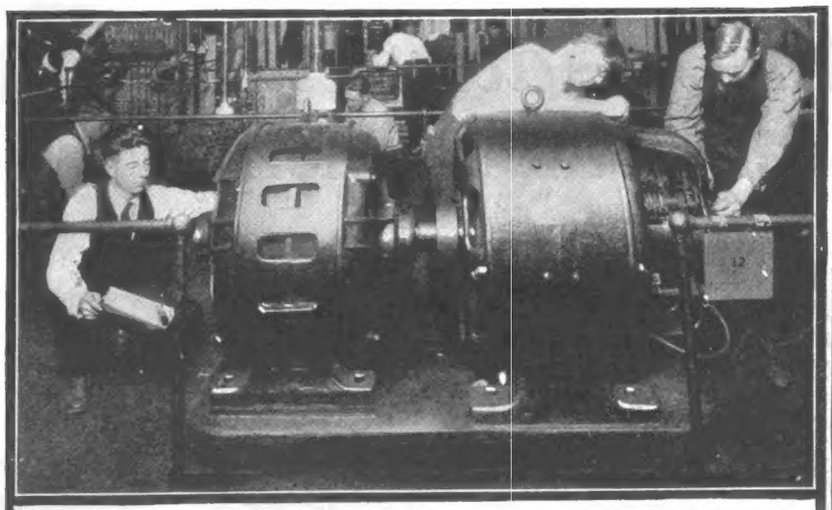

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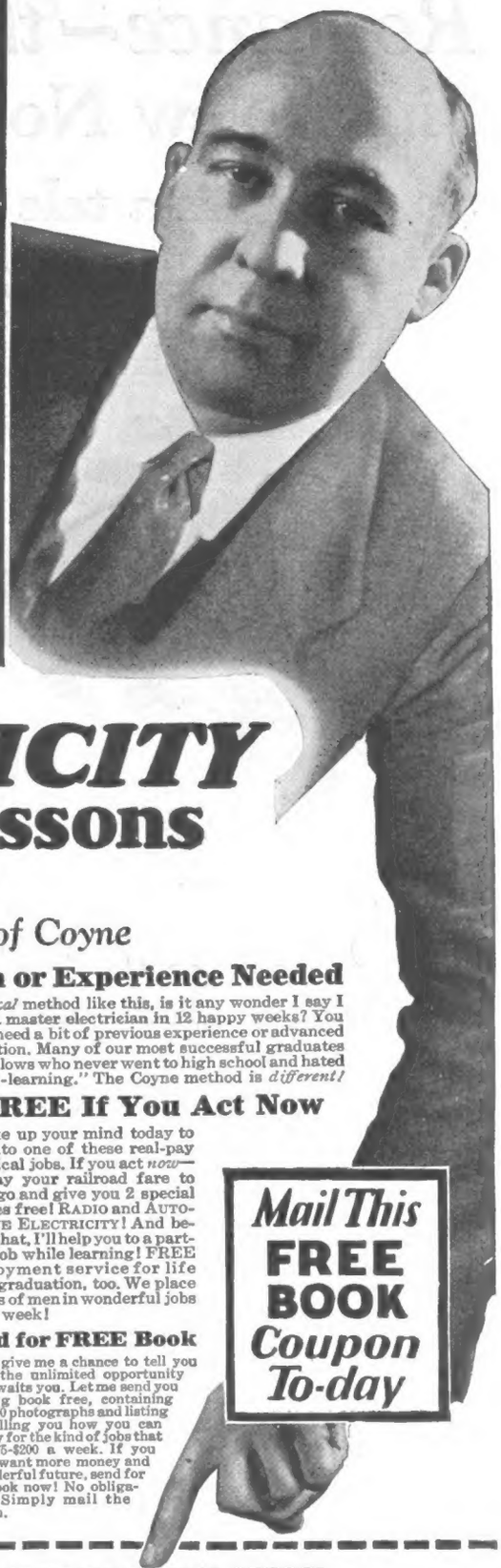

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S. & I. Feb.

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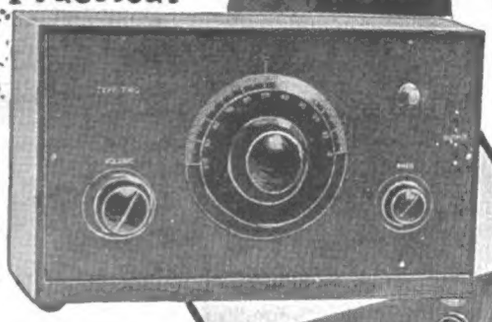

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Volume XIV
Whole No. 166

Science and Invention

February, 1927
No. 10

HUGO GERNSBACK, *Editor-in-Chief*
H. WINFIELD SECOR, *Managing Editor*
DR. T. O'CONOR SLOANE, Ph.D., *Associate Editor*
Editorial and General Offices, - - - 53 Park Place, New York

"Those Who Refuse to Go Beyond Fact Rarely Get As Far As Fact" - - - HUXLEY

HANDICRAFT

By HUGO GERNSBACK

IF a census were taken of the amateur craftsmen and constructors in this country, who build things with their own hands, the result would be astonishing. There are, perhaps, few countries in which handicraft has reached such a wide development as in the United States.

With many handicraftsmen their art is a hobby. Thus we have a banker who specializes in wood-working and building anything from a step-ladder to an elaborate, decorated radio cabinet. An eminent Eastern surgeon has a complete machine shop in the basement of his house, which he uses to turn out the fanciest metalcraft objects that you could wish to see. And these cases are by no means isolated. They are quite prevalent in the various strata of our population.

The scientific reason, if any be necessary, should be simple to understand. Men originally used their hands to toil. As civilization progressed, the use of the hands steadily decreased, as most people, particularly the "white collar brigade," use their hands less and less, and only for extremely light tasks. The professional writer, who uses a pen; the business man, who uses his hands to sign checks and handle papers, all instinctively crave an outlet for the muscular energy of their hands. Little wonder then that in their recreation hours they get busy with tools and do arduous physical labor, for which the hands originally were made.

Aside from all this, there is the huge satisfaction that every man gets from building things himself. It is one thing to step into a store and buy an article, but quite another to make the self-same article yourself, after your own design and after your own ideas. Even making a rather commonplace article —that is, providing it is made right—is a whole education in itself.

If, for instance, you are making an elaborate radio console for your living room, you will get more information on the subject than you could possibly get from the best text-books. You will, first of all, become familiar with the various tools necessary to fashion the wood, and if you own a wood-working lathe you will learn quite a good deal about the operation of wood-turning and the tools to be used for this particular purpose. You will learn what it means to sand-paper, you will learn to recognize the different kinds of wood, and you will know the difference between green and kiln-dried variety of woods. You will soon know how to use glue, and what kind. You will study the various fillers, and, last but not least, you will get a thorough education in varnishes and paints, and the use of all of these.

All this may sound quite formidable, but it really is not, because what the handicraft worker once learns *he never forgets,* and if he has a knack for the thing at all, each subsequent article fashioned by his hands will only increase his appetite along these lines, and spur him on to greater and better things. Of course, you probably would not start in by building an elaborate radio cabinet. The chances are that at first you would make a simple article, such as a shoe-shining box, some wooden toy for the young hopeful, or other simple devices.

If, on the other hand, your ideas run along metalcraft, you will get an equally good education. You will soon learn the difference between cast and wrought iron, between tungsten steel and soft iron; you will know the exact angle at which you have to sharpen your drills to use in your drill press or in your speed lathe, and you will know how to treat the various metals, be they brass, aluminum, or iron. When it comes to finishing the metals, you have an endless variety of processes to choose from, and your adventures in this branch alone will be many and varied. You will make many discoveries that will delight you and bring you into fields of which you did not dream when you started to make even such a simple article as even a decorated, chased, old-fashioned jewel box for your wife.

In metal work, just now, wrought iron is in great vogue. Some of the most beautiful decorations for home use are actually fashioned from the lowly iron, and in some of the art shops you will find the most exquisite tables, gates for living rooms, floor and table lamps, screens, mirror frames, etc., with floral decorations. The flowers are usually made of wrought iron and decorated in silver, gold, or the modern rust and polychrome finish, now so much in vogue. It does not take a big factory to turn out such articles in the home. Quite the contrary, a good coal stove, or a blow torch, can be used to good advantage to fashion the various articles, welding together different parts, and making the most artistic decorations imaginable. Such articles fetch high prices in art stores, not because the intrinsic value of the articles may be high, but on account of the huge amount of labor that goes into them. For instance, making a wrought iron rose takes about three or four hours of labor, that is, just for a single flower. The decoration of it takes another half hour.

It is true that the art stores are not greatly worried about this, because most people will always stand ready to buy anything they see, but only those handicraftsmen, who fashion things with their own hands and can point with pride to an object, saying, "I made this myself," will know the real thrill and the genuine satisfaction of having labored to produce a beautiful result.

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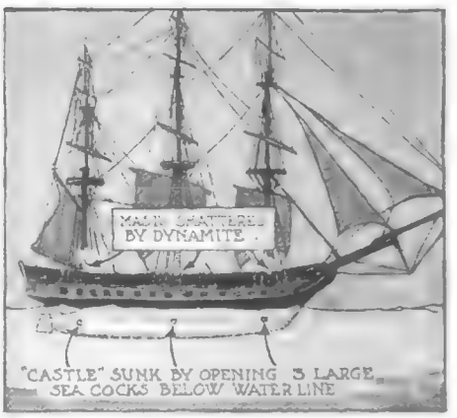
Mr. Hugo Gernsback speaks every Monday at 9 P. M. from Station WRNY on various scientific and radio subjects.

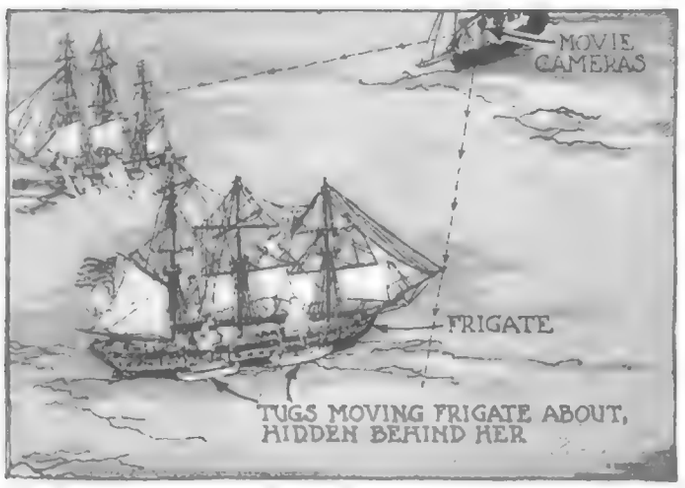
How "Movie Battles" Are Staged

"Old Ironsides" Reconstructed for Great Movie Production. Land Battles with Actual Trenches, Hundreds of Airplanes, Cannon, and All the Impedimenta of Real War.

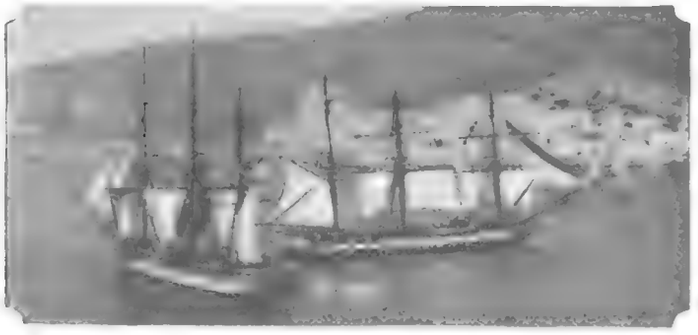
One of the favorite epics of American history is the story of the U.S.S. "Constitution," the most famous ship of the American navy. The exploits of the "Constitution" and her victory over the pirates of Tripoli have been made the subject of a feature motion-picture called "Old Ironsides," which is the affectionate title given the ship in commemoration of an incident in the battle of Tripoli. The Paramount Company expended nearly $2,000,000 in filming the story of the famous frigate shown at the right in the photo above.



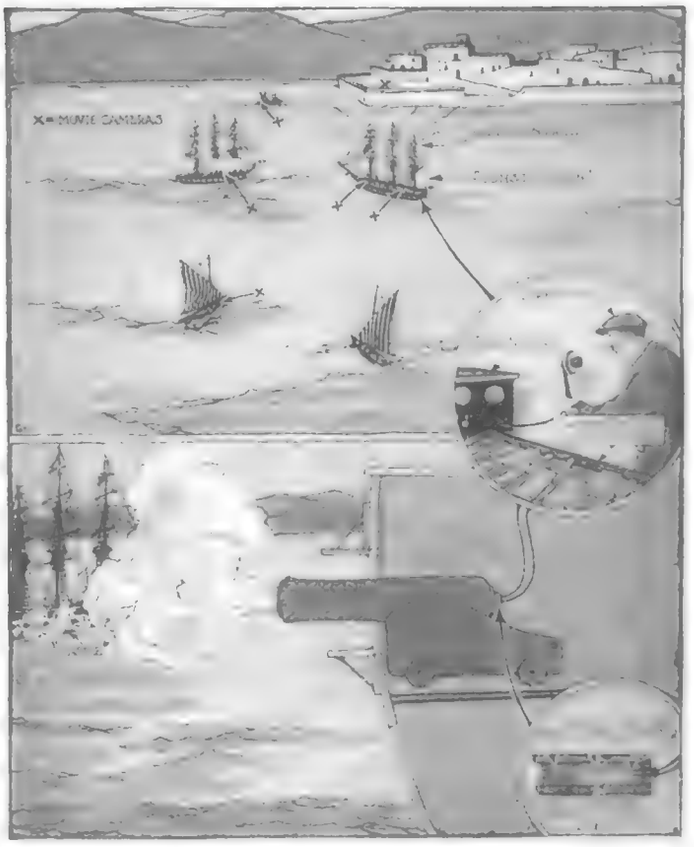
The photo at the left shows the beginning of the encounter between the "Constitution" and the "Castle," the flag-ship of the pirate's fleet. The battle resulted in the sinking of the Tripolitan craft. The super-structure was dynamited in simulation of the destruction by gun fire, and the climax was reached when the "Castle" was caused to sink below the waves by opening three large sea-cocks below the water line. A large number of ships were used to furnish nautical atmosphere.



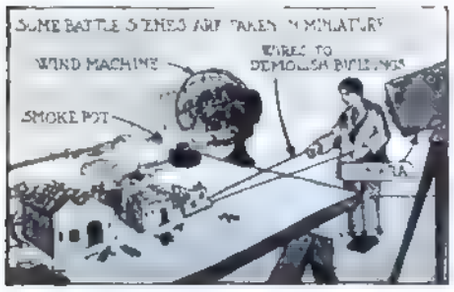
During the making of the picture it was found that the ships had a tendency to drift from their appointed positions, making it necessary to maneuver them with the aid of concealed tugboats which were kept out of camera range.



In addition to the building of reproductions of the famous man-of-war, the producers built a replica of the fort of Tripoli on a hill-side of Catalina Island. It was originally planned to make the picture in the Mediterranean, but due to the Riff uprising it was found impossible to make the necessary arrangements. In this case, as in numerous others, California "doubled" for a far-off land.

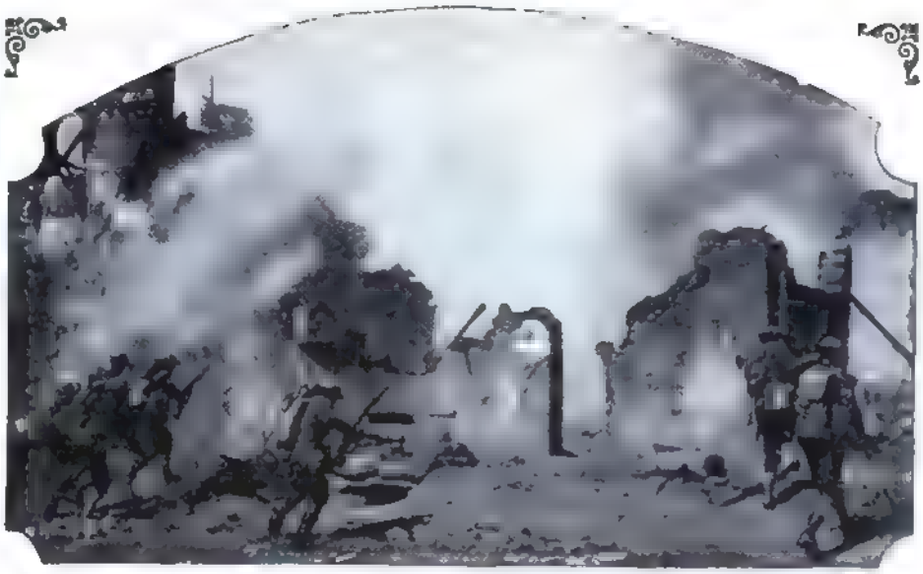


Radio was used by James Cruze in directing the movement of the ships, as we showed you in the radio section last month. A small broadcasting station was employed, sometimes on the "Constitution," sometimes on land, with receiving sets on each ship and several land points. The cameras were situated at various points, in the upper scene they are marked by crosses. The cannon fire was controlled from a number of keyboards stationed on the various ships. Orders were transmitted to the gunners by radio, and the depression of their control keys fired the cannon electrically. Black powder charges made up in cartridge form were inserted in the guns previous to the making of each scene.



In "The Dark Angel" and many other photoplays, model war sets are constructed as above.

Full size sets are sometimes used, of which the above is an example.

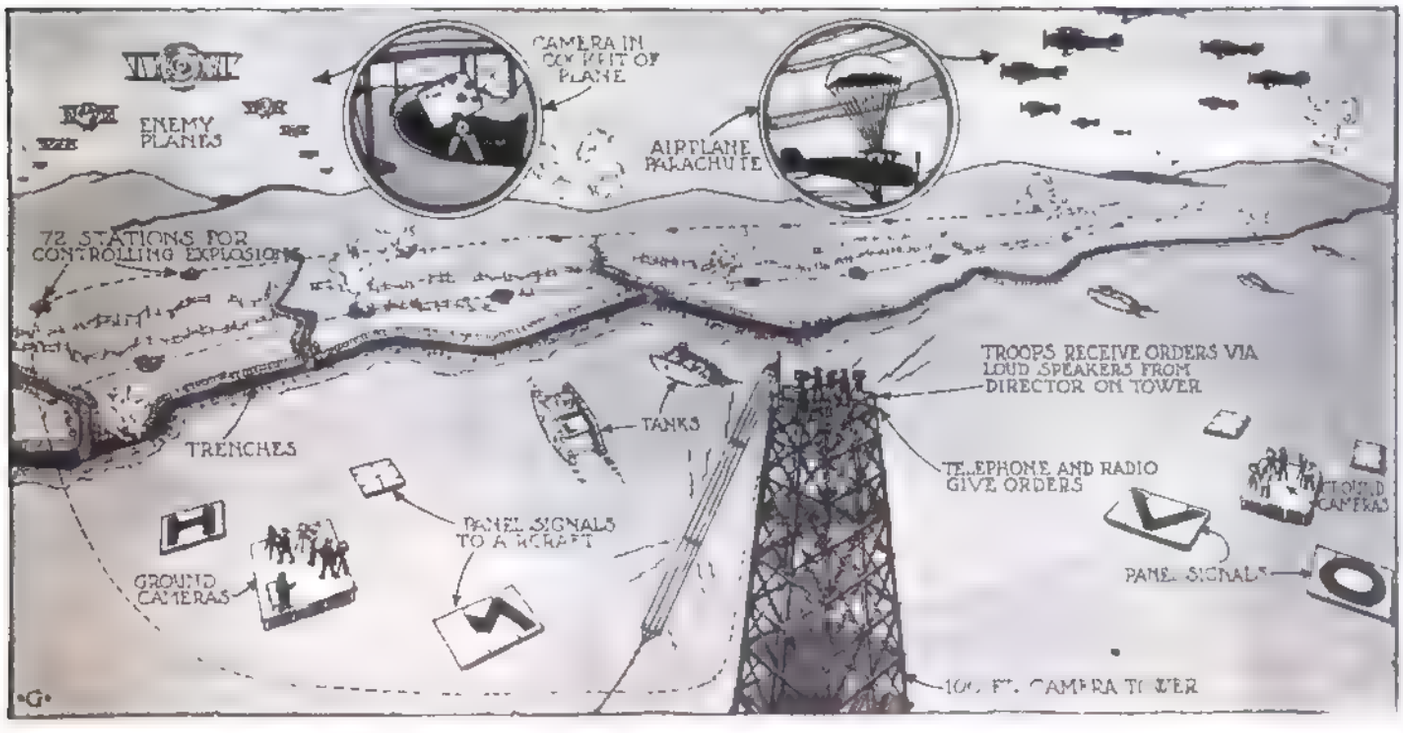


War pictures are difficult to film because of the arrangement of sets required and the complicated mechanisms which must be employed. "What Price Glory" has many scenes like the above.

Fortifications and trenches are built at great expense to add realism and authenticity to the story. The capture of a German trench is shown in this scene from one of the best of the feature of this year.

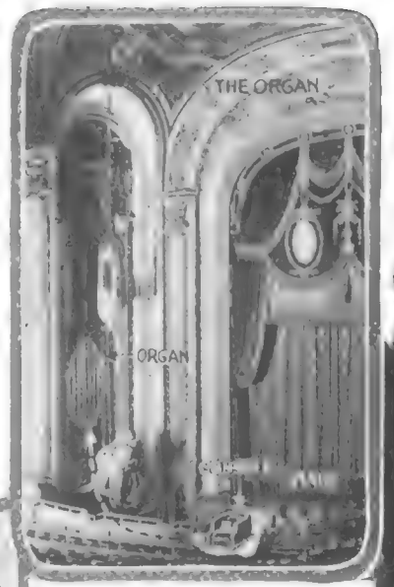
In the Paramount feature picture "Wings," five square miles of terrain in the vicinity of San Antonio were torn up to simulate the appearance of the battlefields of St. Mihiel. Trenches were cut and bombs were used to make craters.

Director William Wellman, in filming the battle sequences of "Wings," employed five means of communication: radio, amplifiers, telephones, semaphores and panel signals were utilized. To safeguard the lives of many aviators, a parachute was developed which lowers a disabled plane safely to the ground. Some of the photography was done from airplanes and high towers.



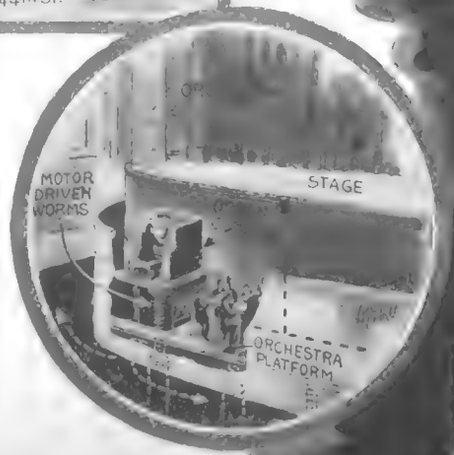
World's Finest Theatre

Eighteen Million Dollar Movie



This magnificent theatre contains the largest orchestral organ in the world. The console contains four manuals, controlling two organs on either side of the proscenium arch. The photograph above shows the position of the organ loft to the left of the stage.

A great glass globe representing the world is always lighted at night. Clock mechanism flashes at hourly intervals.



The appearance of Times Square in New York City has been completely changed in the past sixth months by the erection of an office and theatre building on Broadway from Forty-third to Forty fourth streets. The Famous Players-Lasky Corporation purchased the old Putnam Building site at Times Square and proceeded to break all construction records by completing a thirty-five story office building in twelve months from the time of breaking ground. The Paramount Theatre, which forms the nucleus of this immense structure, is called the world's finest theatre. It contains all the latest developments in theatre art and science. The orchestra platform and organ console are placed on electrical elevators, so that they may be raised and lowered individually, as shown in the circle at the right.

Opens in New York City

Theatre Seats Thirty-nine Hundred

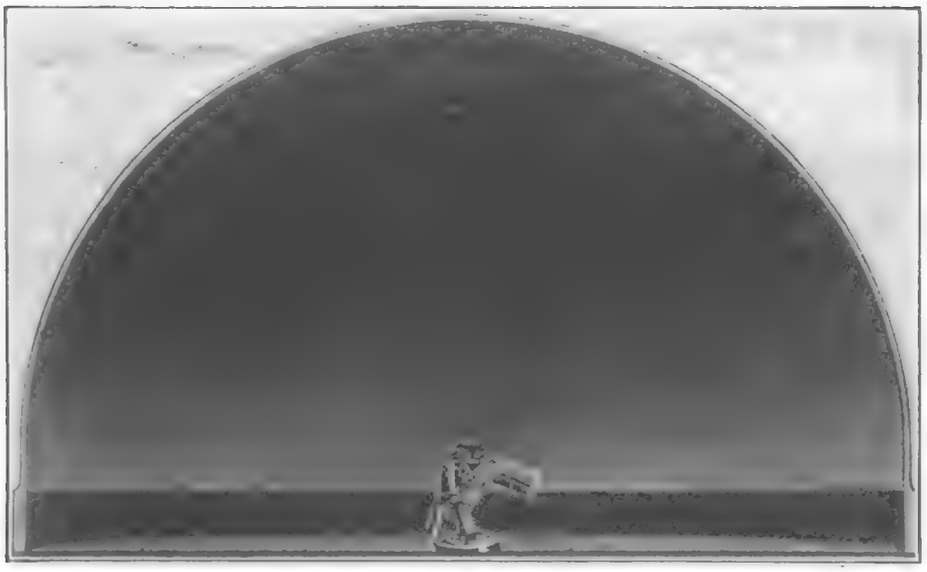
THE large wash drawing covering the greater portion of this page shows the details of construction of the auditorium and lobby of the new theatre. The grand lobby is one of the most impressive features of the ensemble. It is said to compare favorably with any of the European masterpieces of theatrical architecture. The lobby is approximately 144 feet long, and is paved throughout with marble tiles. The first twenty feet of the side walls are composed of marble obtained from a mine in Italy, opened after many years of inactivity for the special purpose of decorating this beautiful building. An interesting innovation for the convenience of patrons is illustrated in the circle above. A very complete electrical indicating system is arranged, so that ushers in various parts of the house may indicate seat vacancies by a signal board near the stairway in the main lobby. The chief usher, by referring to this central board, may tell just how many vacancies there are and their exact location.

IMMEDIATELY under the music room, indicated in the drawing above, is a marble archway, opening into the "Hall of Nations." In a large panel at the far side of this hall are imbedded stones representative of a number of foreign nations. These stones were presented in many cases by high officials of the governments of their native countries. In the music room, which is in the form of a balcony above the archway shown in the insert, artists perform continuously for the entertainment of patrons standing in the lobby and seated in various portions of the lobby promenade. It is interesting to note that elevators are provided for service to all floors of this theatre, running all the way up to the rotunda promenade, which is at about the tenth floor.

THE auditorium of the Paramount Theatre is treated in the French Renaissance spirit, and the color scheme is ivory, rose and turquoise. The ornamentation has been particularly studied for scale, so as to be proportionate to the size of the auditorium and, although the auditorium is over 10 floors in height, the architects have achieved an intimate effect. The result is that the theatre is truly one of the sights of New York. The height from the orchestra level to the dome of the rotunda is about 140 feet, quite sufficient to make it possible to place a 10-story office building within the space occupied by the auditorium. The theatre is completely equipped with the finest of stage and lighting mechanisms, and effects may be obtained which are beyond the ambitions of most theatres. The visitor may obtain a magnificent view of the interior of the theatre from the rotunda promenade, which surrounds the dome vault, 10 stories above the floor of the theatre. The cooling system is graphically represented in the drawing above, which also indicates many of the details of construction far too numerous to list in the text of this article.

Artificial Sky

The New Zeiss

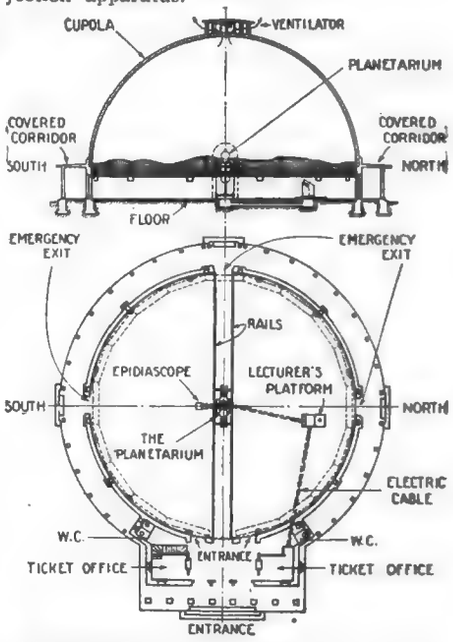


The Zeiss Planetarium with cupola nearly eighty feet in diameter, the inner surface of which is supposed to represent the vault of the heavens. This hemi-spherical surface is the screen on which the complicated projection apparatus in the center projects representations of the celestial bodies, stars, planets and moon, so that one feels as if they were out in the air under a brilliant night sky.

BEFORE the World War the director of the German museum in Munich, M. de Miller, asked the Zeiss firm at Jena to construct for the museum a planetarium, which would make possible the demonstration of the course of the planets before a large number of spectators at once. Its hitherto unattained perfection is due to the technician of the firm W. Bauersfeld. The idea of representing the celestial bodies by little spheres was abandoned and optical projections were substituted. How to get the motions by projection was an extremely complicated problem.

The Planetarium constructed by the Zeiss concern makes it possible to show astronomical phenomena of such diversity that to do it mechanically has hitherto appeared to be an absolute impossibility. The ingenious idea developed in this Planetarium is due to one of the technical engineers of this establishment, W. Bauersfeld; to him this progress in instructive mechanics is due. Mr. W. Bauersfeld completely puts aside the system of representing celestial bodies by little balls moved by any kind of mechanism. He, therefore, made the substitution alluded to, and this was productive of a high degree of simplicity. It centered all the apparatus in a small space, because, optical projection being used, it was simply a question of constructing and supporting and giving proper motion to a set of magic lanterns or stereopticons, as we may term them. But while on the face of it, this seems very simple, and while it does dispense with very clumsy mechanism of the old type, the construction of the apparatus presented an extremely complicated problem. Scientific knowledge and technical construction were intermingled in a way that only a house of the grade of Carl Zeiss at Jena could cope with.

The spectator goes into a cupola twenty-five meters or about eighty feet in diameter. The whole interior surface is white. The horizon of the place is traced upon the surface. Several rows of chairs surround the projection apparatus in the corner of the cupola. At first sight the projection apparatus resembles a pair of opera glasses, but looking at it more closely one sees that the objective or projection lens is replaced by thirty-one little projection apparatus of great precision, each of which projects a definite portion of the celestial sphere upon an area of the hemispherical wall. As a sort of counterpoise and covered by a glass shade, there is a cylinder containing the different mechanisms for projecting the sun, the moon and the planets; the invisible planets such as Uranus and Neptune, as well as the moons of Jupiter and Saturn are not represented. The instruments embody axes, one a polar axis and the other the axis of the ecliptic for the planets, the moon and the sun. There are two electric motors. The audience first sees the fixed stars come out in all their splendor. The illusion is so complete that we seem to be looking into the infinite depths of the sky. Four thousand five hundred stars are shown. After a while the names of the different constellations are also projected. This requires a second projection apparatus.



The upper figure gives a section of the planetarium, while below is shown its plan. The great size of the installation can be appreciated when the entrance shown on the plan which is a large classic columnar porch, is contrasted with the great circular building behind it.

Above is shown a perspective view of the extremely complicated projection apparatus. It has to take care of the planets in their motion each with its own individual path and speed, of the stars all having the same motion, and not the motions of the moon and of its different phases. This view gives an idea of the magnitude of the building. The impressive approach with an esplanade and flight of steps leading into a porch with a row of columns on the front and the beautiful hemisphere behind it makes it a most attractive piece of architecture.

And now the celestial sphere begins to turn and the phenomena of a winter night appears, with the rising and setting of some of the constellations or the paths of others around the pole. Then comes daylight, but which, while showing the sun, does not obscure or put out of sight the planets. Then comes the moon, which pursues its path and shows all its phases from the crescent to the full moon. Last of all come the planets. Mercury, the nearest to the sun, follows its orbit rapidly; Venus appears moving more slowly; Mars moves still more slowly, but Saturn and its ring is yet slower. From five thousand years ago to five thousand years in the future the heavens can be shown for any given date. Three different speeds can be given to the apparatus, four and a half minutes, two minutes, or fifty seconds can represent a celestial day, or a whole year can be given in four and a half minutes down to a few seconds. The earth can be arrested on its axis, which holds the star stationary, while the moon and the planets continue to move. The relation of the rotation of the earth and the apparent motion of the stars is clearly brought out.

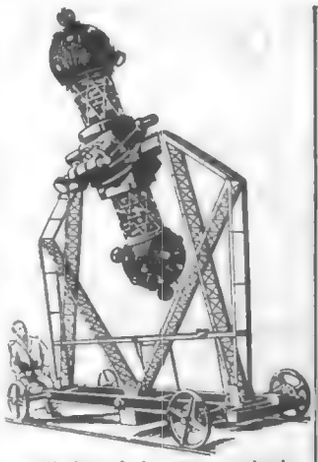
The apparatus comprises two similar parts, one above the other and below the horizontal axis. All the northern constellations are projected by the spherical portion of the upper division, while the cylindrical body, which carries the apparatus, projects

For Students

Planetarium in Jena

the moon and two planets, the lower part projects the meridional constellations and four planets. Besides this in A, is the apparatus projecting the names of the constellations, and in B are the projectors of the Milky Way. In C are contained not only the projection apparatus for planets of the solar system, but also the necessary apparatus for carrying out the movements of the sun, of the moon, and of the planets Mercury, Venus, Mars, Jupiter and Saturn. Finally in D are placed the apparatus for the projection of the representations of the great circles (equator, ecliptic and meridian) by luminous lines which are especially used when the Planetarium is employed for teaching. The whole thing is carried on a truck which moves on rails; the lighting is done by electricity.

The weight of the apparatus, including the frame and the car, is about four thousand pounds.



Installation of the great projection apparatus of the planetarium. The great frame has its dimensions made appreciable by the man seated near it. It is set and mounted so as to give the heavens the effect they would have if the sky was seen from the equator.

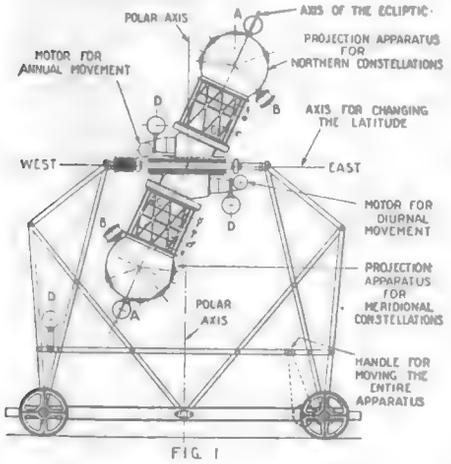
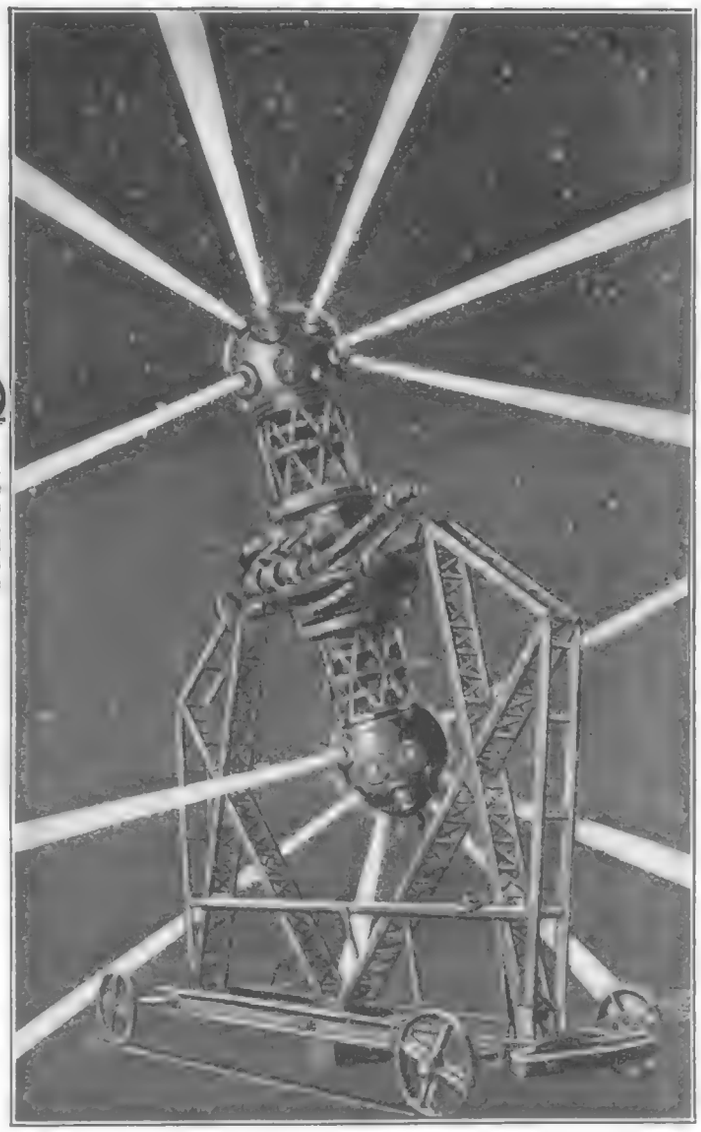


FIG. 1

Side view of the projection apparatus carried on its frame with its different parts named on the drawing. It is far more complicated than even this representation shows, as it has so many moving bodies to represent.

A better idea of the giant structure can be obtained from the photo given on the right. It would seem to be so bulky as to impair the illusion, but it must be remembered that it stands in the center of a giant dome.



Indian Fakir Lives On a Rope

NEXT after Egypt, India is the land which is celebrated for or rather plagued with the most beggars. A certain class of these do not reckon themselves among the beggars, but call themselves ascetics, hermits, monks, fakirs, or something else, which will have a more impressive effect upon the outer world. It is true that many of these are religious fanatics, who do penance upon themselves in various ways, partly for obtaining in their own conviction a holy state of existence; partly to win fame for themselves and attract the attention of tourists and by-passers and get alms from the same.

The man shown in the picture has for his specialty to lie stretched out upon a slack cord for days, for weeks or for years—yes, for all his life! This is an exhibition which in no other country than India could support a man's existence, but here it is a quite profitable way of obtaining a livelihood.

Regarded as a mere feat of balancing, it is certainly a very fine exhibition of the magician's art, which can excite our astonishment to the uttermost; but it is also a refined way of doing penance on yourself; a slight cord is certainly not a very comfortable bed, especially when one has to lie there for a long time. When the man is tired of lying on it, he suspends himself bodily as we see in the picture, that is to say, freely swaying with head and feet pressed against the bamboo poles.

Above is shown a Hindu fakir who spends much of his life on a single rope, an extraordinary feat of balancing. He seems to be contemplating a flower, perhaps a sacred lotus. A curious concession to which we may call modernity in the language of the theologians is the umbrella. The fakirs sometimes support themselves from the poles, and the insert gives the idea of how this can be done by straightening out the body and pressing in both dirctions with head and feet. Below is a cloth or rug with receptacles for coins thrown by spectators, for the fakirs like to make money.

The Indian Rope Trick

By J. K. WRIGHT

The insert here shows how the duralumin members are made. These are placed under a rope covering.

The Indian rope trick, in which a coil of rope is thrown into the air, and it remains in a vertical position while a boy ascends the rope and disappears in a cloud of smoke formed while the trick is being demonstrated. There are few if any authoritative reports concerning this stunt, nearly all the data being obtained from hear-say evidence. In the illustration given here we find a new method.

The Hindu at 1 is producing the smoke screen to hide the boy, 4, when he disappears on the roof of building, 3, to be later found in the cage, 5.

THE Indian Rope Trick, mentioned in every itinerary of the Orient, has been made world-famous by the fakirs of India, and as with all other unexplainable feats of legerdemain, the performance has usually been ascribed to hypnotism or even crowd-mesmerism. The rope, in accordance with this version, is merely cast aloft, and in the interval of the throw and before its descent, the spectators are hypnotized, their eyes seeing not, their minds retaining only what is told them by the fakir.

India is the land of a thousand iron-bound castes, no caste will enlighten another, each looking upon the caste lower as defilement if even thought of; but all the various strata are combined to defeat the foreigner. The natives of India keep their secrets. To this day it is unexplainable how the natives were kept advised as to the movement of troops, the fall of cities, and other information which the British with the aid of heliograph and messenger were days in forwarding.

An Indian fakir is generally a descendant in a profession, be it entertainment, plain alms-seeking or disguised under some fanatical religious devotion. From childhood he assimilates knowledge pertaining to his particular bent, and practices with the patience only had by the Orientals, considering himself extremely well provided for if he obtains a single, simple meal every day. Hence his public appearance may be certain to be as perfect as humanly possible.

The performer of this rope trick must first of all have his rope, which if ever closely examined will be discovered to be a jointed affair, flexible in one direction only. This rope in the old days of the trick had to be assembled from carven pieces of selected teak. Even after the most careful assembly it might have broken in a dozen different places. When it tested to the builder's satisfaction, it was given a woven sheath so that in appearance it was identical with other coils of rope in his possession. Then for months on end, the fakir would practice the handling and casting of the pseudo and ordinary ropes. When it was possible for him to cast the jointed rope to such perfection that it simulated that of the ordinary, he would then obtain an agile boy of small size and weight and initiate him into the mysteries. Under-nourished and illy cared for, so that all growth had ceased, the boy selected for the work could be counted upon to maintain utter silence and to perform his part to perfection. To him it meant the realization of a Cinderella dream—he would have food each day and a place to sleep at night.

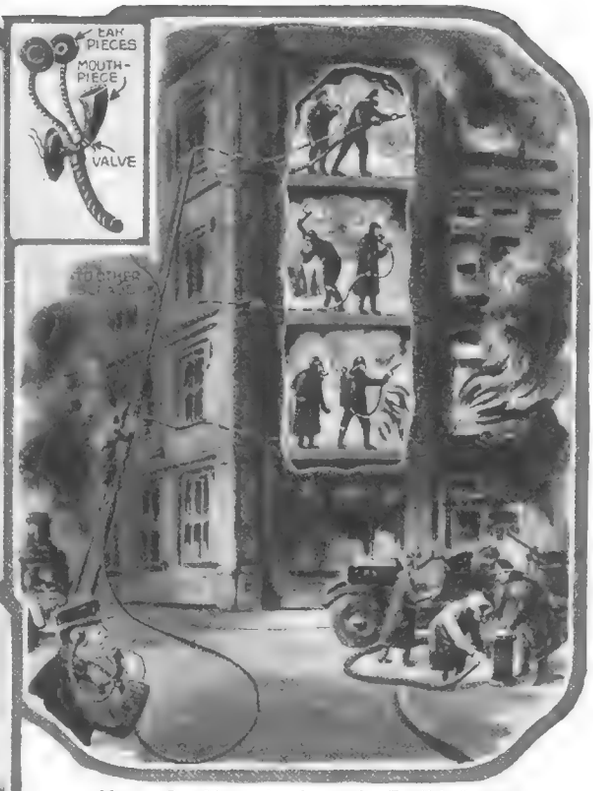
The performance would take place in a narrow alley, flanked with low buildings, or else in the end of a blind alley. Natives with tom toms and shrill pipes would serve to attract a crowd. When enough spectators were gathered one of the attendants would carefully increase the smudge from the incense until a suitable smoke screen was built up. The performer the meanwhile would be untangling, coiling and arranging his ropes with care and great display, and then unostentatiously the prepared rope would be selected and thrown into the air. It would uncoil and remain in the air with a slight arc, the incense ascending in carefully regulated clouds, so that the end extending into air was visible at times and completely obscured in other intervals.

At a command from the fakir the boy would run forward and begin to clamber up the rope, the fakir revolving in a circle the meanwhile. When the boy ascended above the roofs of the shops he would pause until

(*Continued on page* 950)

Radio and 'Phone for Firemen

The photo above shows modern English fire fighting equipment, the powerful apparatus on the left being a new engine which sprays foam for use in smothering oil or gasoline fires. At the right of the photo above we see the latest smoke helmet fitted with a speaking tube. The artist's picture at top right shows the speaking tube in use, so that firemen who may get marooned in any part of a building, may communicate with the chief. The usual whistle signal is employed.



Above: Speaking tubes in use by English firemen.

THE picture at the immediate left shows a remarkable new English turntable extension ladder, from which water can be played from a hose on to a fire. Note the nozzle at the top of the lofty extension ladder, which extends eighty-four feet above the ground. The photo does not do the apparatus justice, as this is one of the most beautiful pieces of fire-fighting equipment we have ever seen. It took some clever engineering design to get this whole affair balanced out, so that the ladder, when unfolded and extended upward, would not over-balance the truck which is extra-long as will be seen. The ladder resting against the building and provided with a two wheel truck, has no connection with the turntable extension ladder.

TELEPHONES to be carried by firemen by means of which they may communicate instantly with the chief or assistant chief, represent an idea advanced by H. W. Secor of this magazine's staff. There are several ways in which telephones for firemen can be developed and applied. The first scheme is that involving the use of a two-wire flexible armored cable, which could be run out from a reel and joined to a telephone receiver and transmitter equipment of small size, also fitted into the smoke helmets. Another scheme would be to use but one conductor, preferably of the armored type, which could be attached to the fire hose, the return circuit being through the water in the hose. The inventor suggests that in the future it might not be a bad plan to have one of the conductors, or possibly two of them, woven into the hose when it is manufactured.

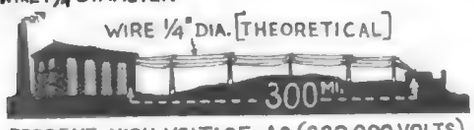
The next step suggested by Mr. Secor in the development of improved safety methods for fire-fighting, is to utilize portable radio sets. With our highly efficient vacuum tube transmitters and receivers for voice transmission, it should be a simple matter for the radio experts in our city fire departments to develop a suitable line of radio transmitting and receiving equipment. Short waves might be used for this purpose.

The picture above shows portable radio transmitter and receiver in use by firemen on a blazing building. By using different wavelengths or special codes, any mixup in signals could readily be obviated.

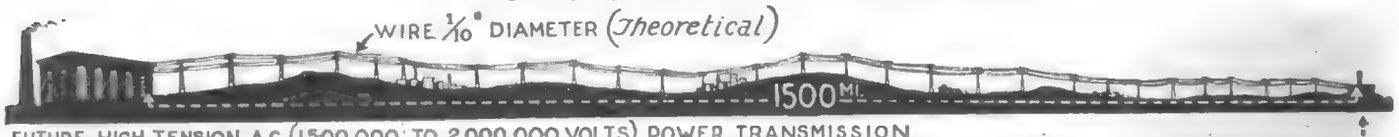
Why High Voltage is Desired

LOW VOLTAGE 500 TO 2000 VTS. D.C. OR A.C. TRANSMISSION, GOOD FOR 10 TO 20 MILES. WIRE 1¾" DIAMETER

ONE of the principal objects that electrical engineers have in mind in the development of such high voltage testing laboratories as that illustrated on the opposite page, is the gradual lengthening of the circuits over which electrical energy may be transmitted efficiently. A glance at the three accompanying picture diagrams shows where we stand today and what the future may bring forth, when our engineers are able to adapt potentials of one and one-half million to two million volts to our transmission line problems. The corona or stray leakage loss along high voltage tranmission lines becomes excessive when the potential is increased much above 250,000 volts, as the diagrams below show. Another problem which high voltage, once it is harnessed to transmission lines will solve, is the reduction of the size of the copper wire, the diameter of which decreases as the voltage increases, with the same load in each case. In other words to transmit 10,000 kilowatts, the engineer who uses the highest voltage possiible will build the cheapest transmission line, as the three diagrams herewith clearly indicate. In the third example of 1500 miles transmission with 2,000,000 volts, a wire the size of the lead in a pencil could be used theoretically, but to stand mechanical and wind stresses it will have to be about three-eighths inch in diameter. With greater knowledge of high tension currents, our engineers in the next few years will doubtless be able to place high voltage transmission lines underground instead of on towers exposed to the weather, especially high winds as well as snow and sleet storms.



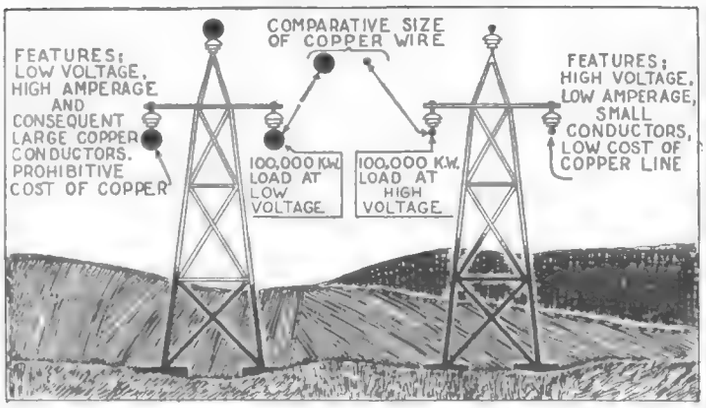
PRESENT HIGH VOLTAGE A.C. (220,000 VOLTS) POWER TRANSMISSION



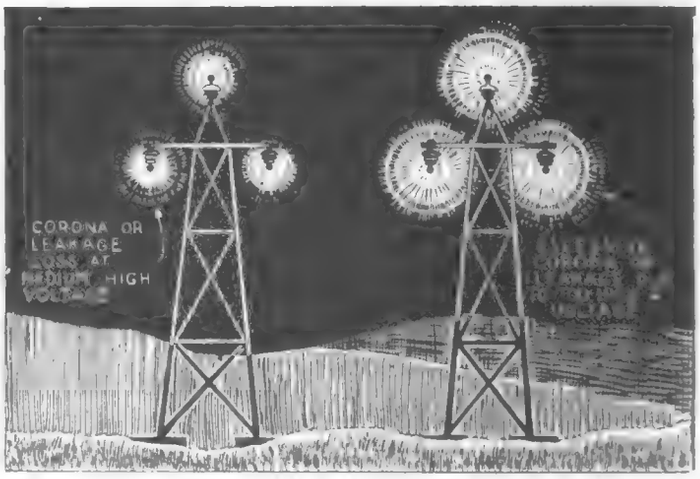
FUTURE HIGH TENSION A.C. (1,500,000 TO 2,000,000 VOLTS) POWER TRANSMISSION

FUTURE USEFUL POWER 1500 MILES FROM CENTRAL STATION.

The three diagrams above show the great difference in diameter of copper wire necessary for low voltage transmission, compared with the present high voltage (220,000 volts) transmission, and what we may expect in the future when 2,000,000-volt power transmission over 1500 miles or more, may become a reality instead of a dream. The main thing that keeps the voltage down is the high corona loss.

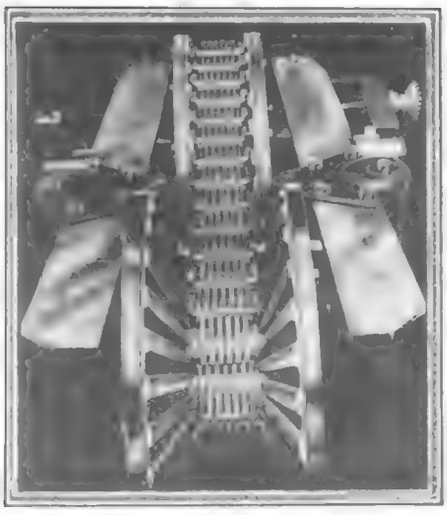

COMPARATIVE SIZE OF COPPER WIRE
FEATURES; LOW VOLTAGE, HIGH AMPERAGE AND CONSEQUENT LARGE COPPER CONDUCTORS. PROHIBITIVE COST OF COPPER
100,000 KW. LOAD AT LOW VOLTAGE
100,000 KW. LOAD AT HIGH VOLTAGE
FEATURES; HIGH VOLTAGE, LOW AMPERAGE, SMALL CONDUCTORS, LOW COST OF COPPER LINE

In the picture diagram above one can see at a glance why it is that to transmit 100,000 kilowatts, engineers would rather use 100,000 volts for example, than they would 10,000 volts. The size of the copper wire decreases as the potential increases, with the same amount of power to be transmitted. Heavy steel towers have to be used to support large copper conductors, which is also a big consideration on a fifty to seventy-five mile long transmission line.

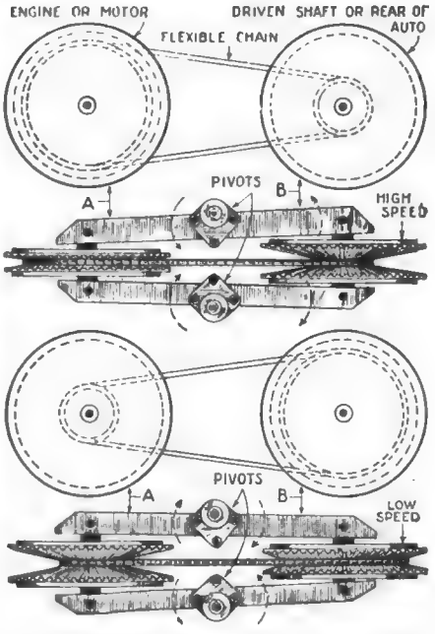


Here we see what happens when the voltage of a transmission line is increased to a certain degree. When the corona or stray electrical discharge exceeds a certain amount, the line losses become prohibitive.

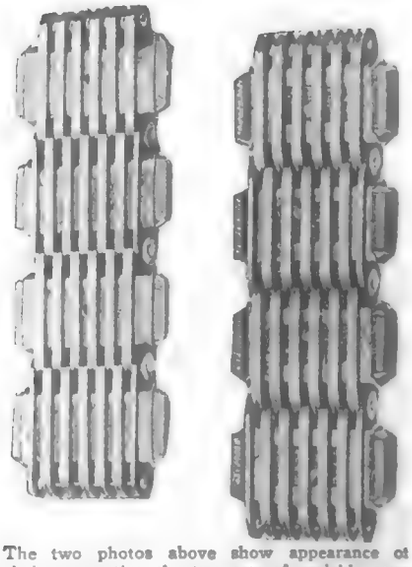
Gearless Variable Speed at Last



A positive drive, infinitely variable gear which has been sought for many years, was recently exhibited in England at a mechanical exhibition. This change speed transmission known as the P. I. V. device is capable of an almost infinite number of speed changes between the driver and driven shafts. It should mark a step forward for automobile purposes.



The two diagrams above show how levers open and close grooved cones and change speeds.



The two photos above show appearance of chain connecting the two sets of variable cone pulleys used in the P. I. V. gear box. With a single lever, innumerable speeds are at one's instant command. It should prove welcome in motor cars instead of the present awkward gear box.

2,000,000 Volts Turned Loose!

A SHORT time ago at the Harris J. Ryan high voltage laboratory of Leland Stanford University, California, there was produced tremendous electrical discharges, as shown in the accompanying pictures, when electrical potentials as high as 2,000,000 volts were turned loose. The purpose of this high voltage laboratory is to test various electrical apparatus, particularly the insulators used on high voltage transmission lines in order to determine accurately the reasons why these insulators break down at high potentials and various other phenomena connected with high tension line operation.

The picture at the left shows the opening exercises at the Harris J. Ryan high voltage laboratory at Leland Stanford University, with Dr. Ray Lyman Wilbur, President of the University, explaining the objects and purposes of the new high voltage laboratory to the engineers and scientists present. This was followed by demonstrations.

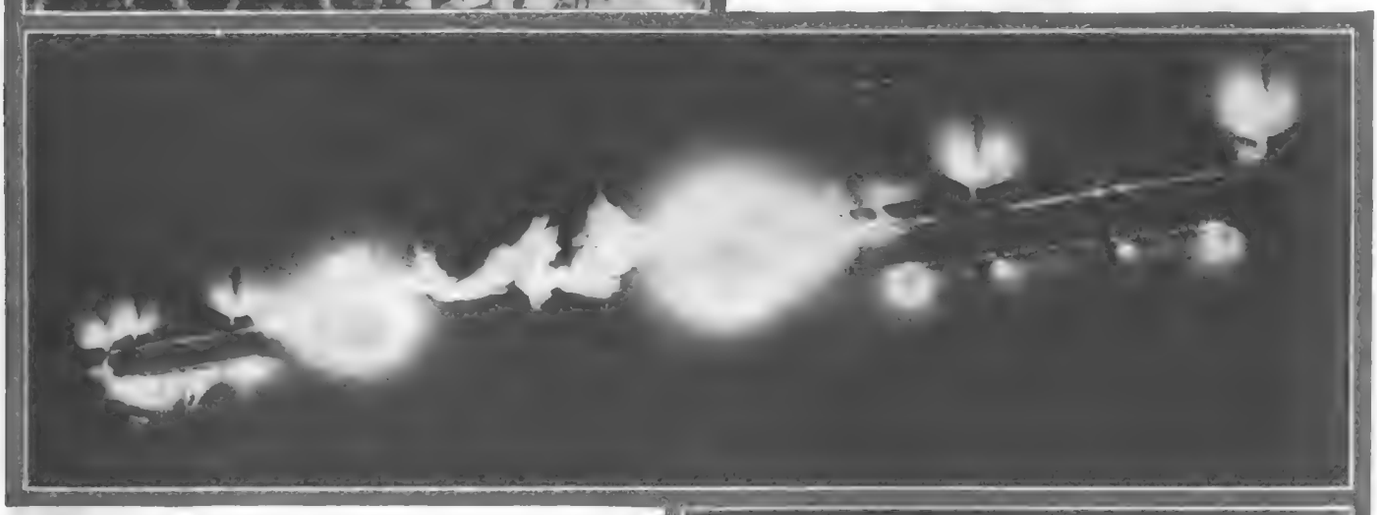
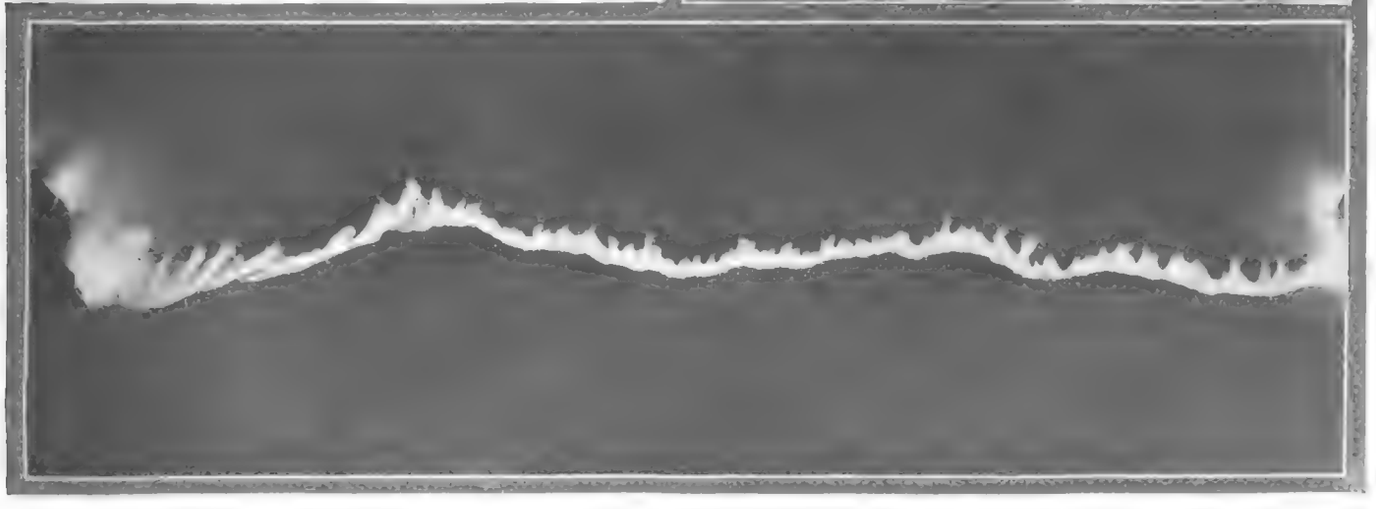


Photo above shows beautiful ribbon-like discharge of 2,100,000 volts. The discharge jumped a twenty-foot gap in many cases. The tests of the apparatus were conducted in total darkness. At first faint sparks are seen to emerge from the electrodes forming eventually a corona. It is this corona or fine web of sparks seen to exist about the wires and electrodes in the dark, that spells wasted power to the designers of long distance high voltage transmission.

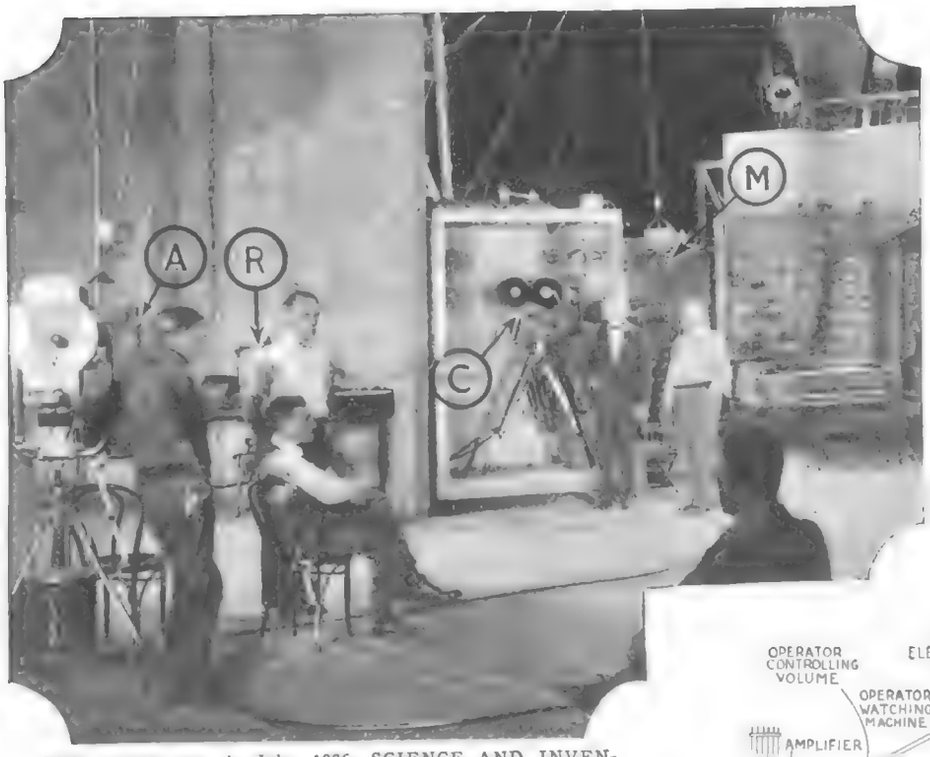
Picture at right shows 2,100,000 volt discharge taking place, and below it four of the six 350,000 volt transformers which were connected in series to give the 2,100,000 volt discharge. Each transformer was insulated from the ground by supporting it on an insulating cylinder. The steel building housing the transformers is 173 ft. long, 65 ft. high and 60 ft. wide. The building is lightproof and will enable scientists to study visually the corona phenomena.

Another picture of the 20 ft. discharge at 2,100,000 volts is shown below and this represents one of the highest potentials ever produced by man. Among the objects of these high voltage tests are the development of better insulators, reduction of line losses and the improved designs of high voltage transformers. Mathematical design cannot be trusted alone in this high voltage work, but should be supplemented by actual laboratory tests, which have now become possible.

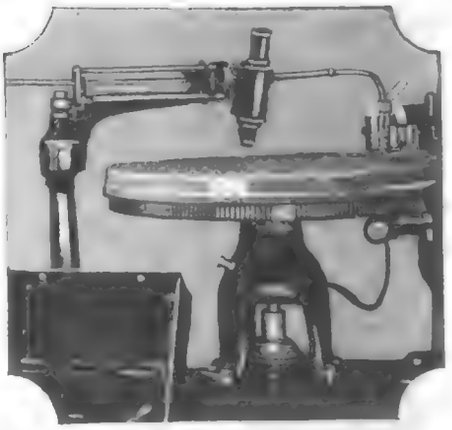


The Mechanism of the Vitaphone

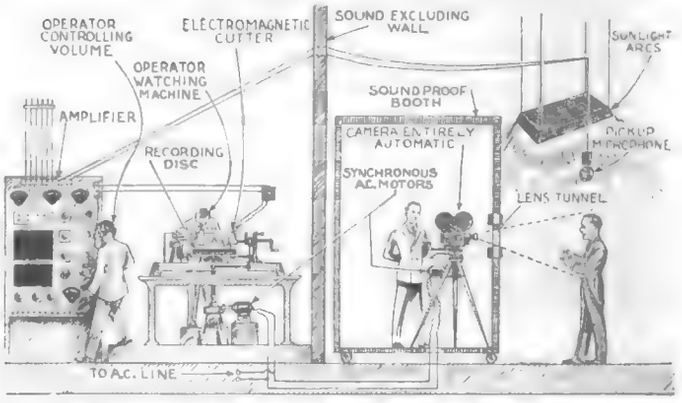
By MARY ELEANOR BROWN



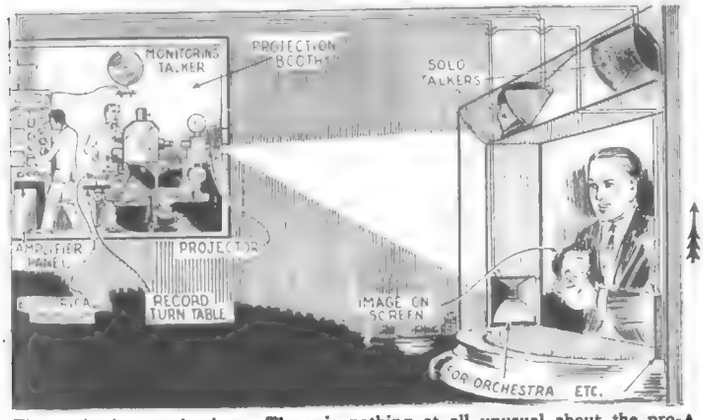
Eight months ago, in July, 1926, SCIENCE AND INVENTION published the first article to appear describing the latest achievement in motion pictures, the Vitaphone. By this process sound and image are perfectly co-ordinated.



Above is seen the turntable and recording mechanism which engrave the sound impulses upon a soft wax disc. The microscope is used to check the accuracy of the grooves cut by the stylus at the right of the disc. At the left, a scene in the Vitaphone studio. M is the microphone which picks up the sounds to be recorded, the amplifier A increases their intensity and the recording mechanism seen above and at R engraves them. C is the motion-picture camera.

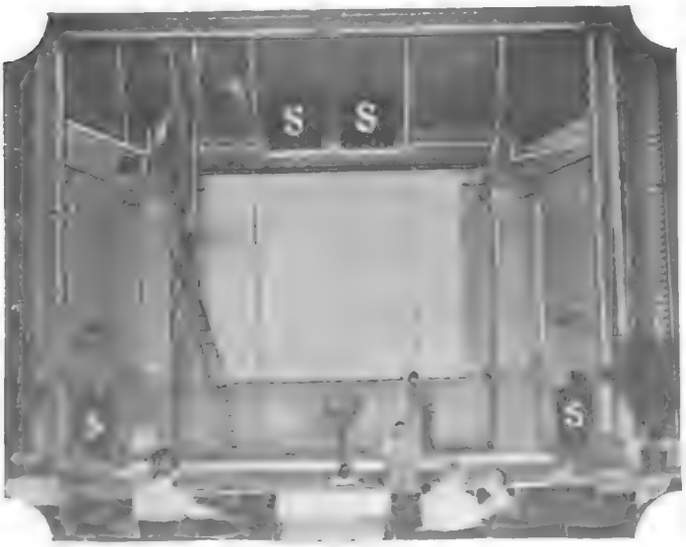


The recording mechanism. The camera and recording machine are run by synchronous motors. The details of the mechanism illustrated in the drawing above may be compared with the photograph. The camera booth may be moved about regardless of the rest of the apparatus.



The projecting mechanism. There is nothing at all unusual about the projection mechanism, as will be seen from the drawing. The amplifier, as in the case of the one used in the recording mechanism, is practically identical with that used in broadcasting stations. Both the turntable and the projector are run by the same motor. The Vitaphone is rented to theatres by Warner Brothers Pictures, Inc.

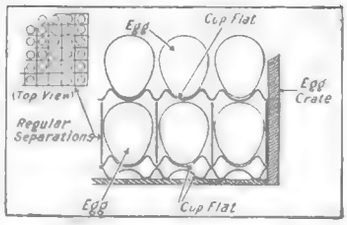
Mr. E. B. Craft, Executive Vice-President of the Bell Telephone Laboratories, gave a very interesting talk at a monthly meeting of the New York Electrical Society on the operation of the Vitaphone, and Mr. Craft is shown above in the projection room. A is the amplifier, T the turntable and R the electrical pick-up. Both turntable and projector are run at constant speed by a single motor.



At the left, the loud-speaker installation which was arranged for the lecture at the New York Electrical Society auditorium. This installation is typical of that employed in theatre presentation, except that it is somewhat more involved in this case than in the average. The talkers are designated by S, the two at the top being used for solos and speeches, while those at the bottom are employed to bring out the heavy tones of the orchestras.

Eggs Safely Dropped from Plane

By GEORGE HOLMES

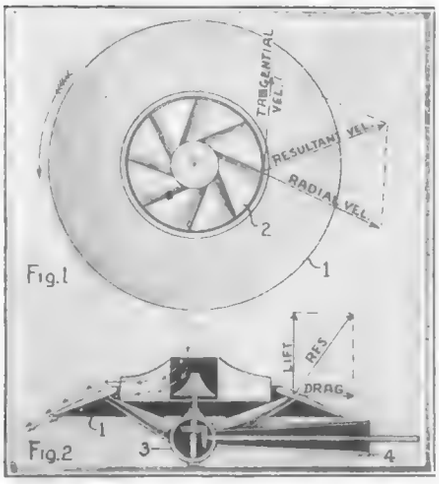


Modern packing methods have made it possible to ship exceedingly fragile mechandise with perfect safety, even where rather rough handling is expected. A spectacular demonstration of this fact was given recently at Curtiss Field, where 24 dozen eggs were dropped from an airplane at a height of 1500 feet, falling unbroken to earth with the aid of a parachute.

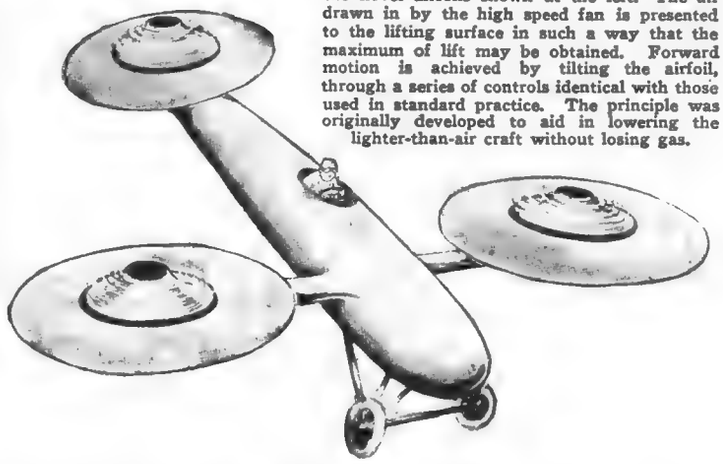
Novel Life Preserver

A rubber collar has been devised for swimmers, which may be blown up to form a buoyant ring to keep the head well above water—if you're not out of breath.

Latest Helicopter Design Provides Direct Lift



In line with the recent perfection of the helicopter to the point of utility by a Spanish inventor, we learn that F. E. Loudy, A. E., a contributor to this magazine, has invented a helicopter which utilizes an entirely new principle. Fig. 1 shows a top view of one of the airfoil units which consists of a circular plane (1) fixed in position at the periphery of a high speed rotary fan (2). Fig. 2 shows a cross-section of the same apparatus, where (3) is the driving gear, and (4) is the housing for the propellor shaft. At least three foils must be used.

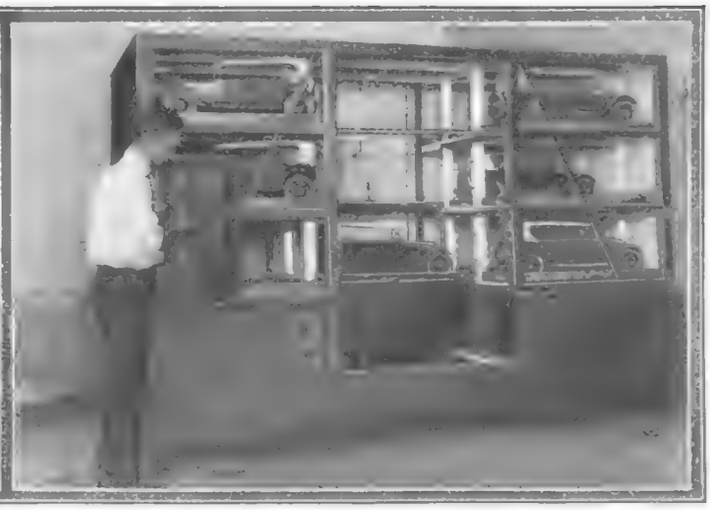


The Loudy helicopter uses three or more of the novel airfoils shown at the left. The air drawn in by the high speed fan is presented to the lifting surface in such a way that the maximum of lift may be obtained. Forward motion is achieved by tilting the airfoil, through a series of controls identical with those used in standard practice. The principle was originally developed to aid in lowering the lighter-than-air craft without losing gas.

Speed In Home Building

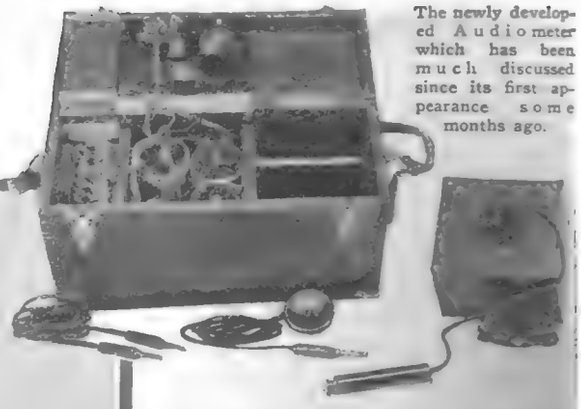
German ingenuity has contributed much to the solution of the problem of housing in congested districts by developing the unit system of home construction. Complete homes may be finished in one day, as shown above, where pre-formed concrete sections are placed on concrete foundations.

A Book-Shelf Garage



Fred J. Cross of Los Angeles, Calif., has succeeded in developing a new idea in garage construction. His model, which Clint Bartlam is demonstrating above, removes the human element completely. The entire operation of moving and parking the car is done electrically.

How Loud Is a Noise?



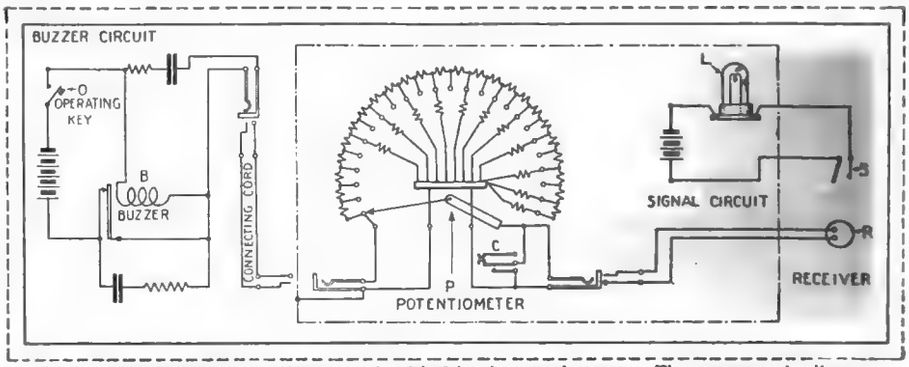
The newly developed Audiometer which has been much discussed since its first appearance some months ago.

The interesting new instrument may be used with slight changes for the comparison of sound-intensities. In the photograph above two engineers of the Western Electric Co., are seen measuring the volume of sound at America's noisiest spot, the foot of the American Falls at Niagara.

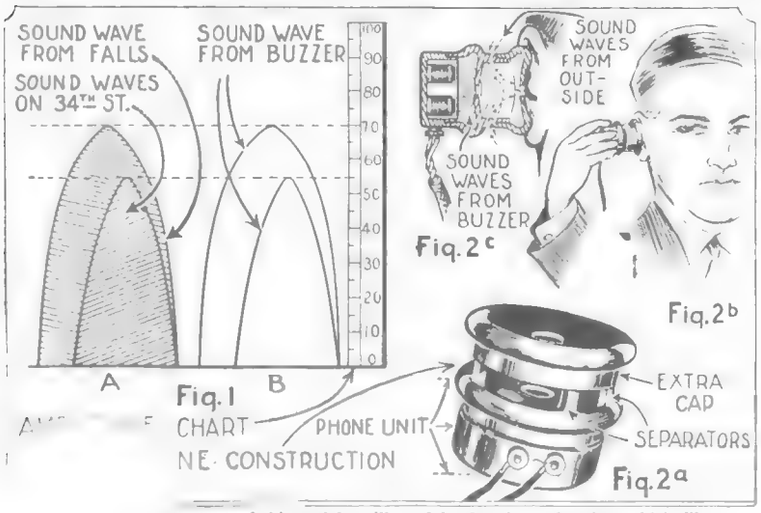
The photograph above shows the entire Audiometer outfit. The large box contains a buzzer and batteries; the small box contains the control potentiometer and signal light with the signal button at the end of a long cord. The other two units shown are the headphone and connecting cord.

ONE of the most interesting instruments which has been brought to our attention for some time has been developed in the laboratories of the Bell Telephone Co. Originally developed as a laboratory instrument, the Audiometer is peculiarly interesting because of its wide field of application.

A description of the apparatus is pertinent before describing its uses. Referring to the diagram at right and the photograph in the upper right-hand corner, each component is easily identified. The buzzer, B, is a standard instrument of wide frequency range which is isolated in the left-hand compartment of the large case and completely surrounded by thick felt pads. This shielding is necessary to prevent the vibration of the buzzer from being transmitted to the outside of the carrying case. The middle compartment contains the dry cells necessary to operate the buzzer, and directly above them in the lid of the case will be found an operating key, O. A small filter system is provided to prevent sparking at the buzzer contacts and to aid in the production of a pure tone. The right-hand compartment of the case is used to hold the potentiometer control box, or *differentiometer*. The small control box with a potentiometer knob protruding through its top contains a potentiometer, P, the short-circuiting button, C, the signal light, L, and its battery and the signal button, S, at the end of an extension cord. The watch-case receiver is plugged into one of the jacks in the small control box. The top of the control box is scaled off so that the position of the potentiometer arm may be easily noted.



This is the authentic circuit diagram as furnished by the manufacturers. The apparatus is all very simple and is well adapted for amateur experimentation.



The text of this article will explain the above drawing which illustrates the use of the Audiometer in sound comparison tests.

The apparatus was designed to afford a comparative test of hearing for school children, auto-license applicants, and in industrial tests, with the following procedure. The subject of the test is asked to hold the receiver over his ear and grasp the extension signal button in his other hand. The potentiometer is adjusted with the arm in the position shown in the diagram, so that a minimum potential will be set up in the receiver circuit, with the result that no sound is heard by the subject when the operating key, O, is closed. The subject is instructed to listen attentively for the buzzer note, and to push the signal light button as soon as he hears the first faint sound. The operator then advances the potentiometer, thus increasing the volume of sound in the telephone receiver, until the signal light flashes. At this point he makes a notation of the potentiometer reading. The test is repeated again for verification, and the signal may be secretly stopped by shorting the telephone circuit with the switch, C. This acts as a perfect check on the voluntary or involuntary shamming of the subject. The hearing reaction of different subjects may be easily compared by reference to the critical potentiometer reading.

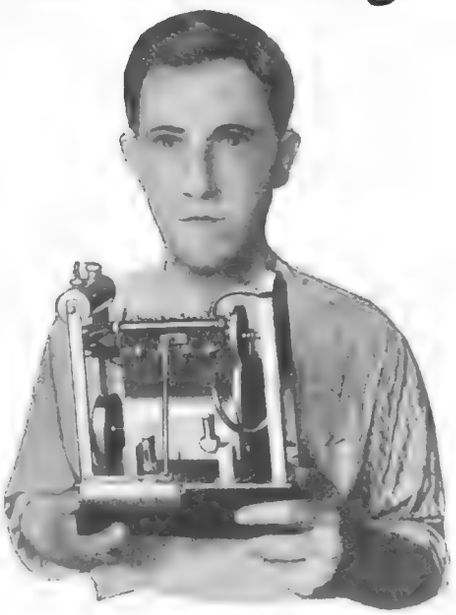
In the drawing at the left you will see how an extra cap (Fig. 2a) is placed over the telephone receiver for [illegible]

(*Continued on page* 951)

All-Steel Body Protects Motorists

MANY of the manufacturers of up-to-date automobiles have adopted all-steel bodies as standard equipment. It has been found through experience that all-steel bodies afford a protection which is double in its value; the car itself is protected and the safety of its occupants is more greatly assured. The incident illustrated at the left took place in Boston a short time ago. Following a collision, this Dodge all-steel coupé turned turtle and it was feared momentarily that its passengers would suffer fatal injury. They escaped unscathed, the only damage sustained by the car being a broken window.

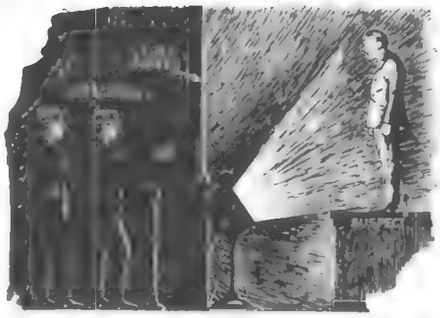
Latest Auto Engine



The latest in auto engine mechanisms is the valve assembly and cam shaft used in the model above. All the moving parts controlling the valve are replaced by this invention of Richard S. Davis.

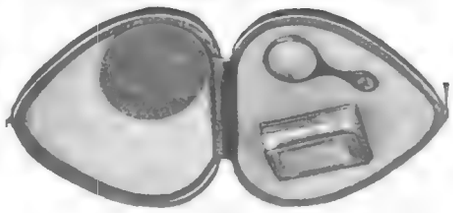
Shadow Box Aids Investigators

The Los Angeles Police Department recently adopted a well-known theatrical mechanism as an aid in criminal investigation. Using this device, the suspect is plainly seen by the examiners while they are invisible to him. As will be seen from the sketch to the right above, the detectives stand in the dark, while the suspects are brilliantly lighted behind a gauze screen.



A light is cast from the back of a gauze screen upon the suspect under test.

The Smallest Known Book

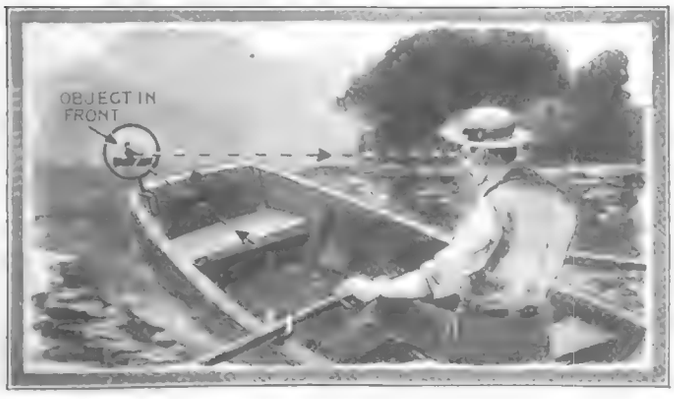


Schoss' illustrated English Bijou Almanac, which measures 7/8ths of an inch by 1/4 inch, is thought to be the smallest book in the world. It is the property of W. P. Spencer.

Siren Calls Life Guards

One of the most popular southern resort beaches has recently installed several electric sirens on the beach so that life guards may be called in case of emergency. The warning device is operated by an alarm box of the type commonly used for telegraphic fire alarm systems. To call the life guards, a small glass window is broken and the switch lever thus exposed is used to operate the siren.

Rear View Mirror Used on Motor Boat



Everyone who has tried to row a boat on a crowded lake has probably wished that there was some method of seeing what lay in the path of the boat. One of our contributors has suggested as a remedy for the usual condition, the adaptation of an automobile rear view mirror to marine purposes, by attaching it to the stern-board of the boat. A little experimentation will show what adjustment is best.

Money From the Scrap Heap

There are a great many things which we throw away daily that can be put to use in slightly different ways and which will reap very handsome financial returns for the individual bold enough to tackle the venture. In England, from where these photographs come, industries are constantly being developed which utilize the material usually thrown away. These photographs indicate the uses to which old iron pots and pans and cockle shells are put.

This heap of pots and pans will eventually become iron sulphate.

A curious use for old iron pots and pans is made at the Beckton Gas Works in England. Old iron is put into tanks of sulphuric acid which converts the iron into iron sulphate. After treatment in another tank, yellow prussiate of potash crystals are made to adhere to strings in wonderful formations. Both iron sulphate and yellow potassium prussiate are used in the manufacture of newsprint paper.

This particular photograph shows the size of some of the crystals of yellow potassium prussiate formed on the strings which were lowered into a tank. The combination of this and iron sulphate with the oxygen of the air makes a blue pigment, Prussian blue, which is used to make newsprint paper pure white.

This photograph shows still another form of the use of old iron pots and pans. Here the employees at the gas works are scraping sulphate of iron crystals formed in the bottom and along the sides of a great tank. Some idea of the size of this tank can be gained from the photograph.

The egg yield of chickens is greatly improved by the stimulating food obtainable from the cockle shell. These photographs show how these shells are employed on the Essex coast, in England. The photo above shows the shells being loaded into large baskets to be delivered to machines which grind up the shells. The photo at the right indicates the sifting machine where the finely ground shells are graded and the ground shells are filled into sacks for shipment to chicken farms. The egg yield of hens is considerably increased by this substance which stimulates the development of the egg shell.

Science Here and There

By the aid of a small saw and a pocket knife Mr. George L. Hathaway, disabled veteran, completed this table with 50,619 pieces of wood.

Here is a view of Chicago's first double-decked traffic artery. It shows the recently completed Wacker Drive from Clark St. Bridge looking east. It winds its way along the river as far as the eye can see.

The photograph here shows the remarkable N. Y. Telephone Co. Building as it appears when looking at it from the Hudson River. This structure was described in the last issue of this publication.

It is obvious from the photo above that traffic congestion will be considerably relieved by this artistic structure.

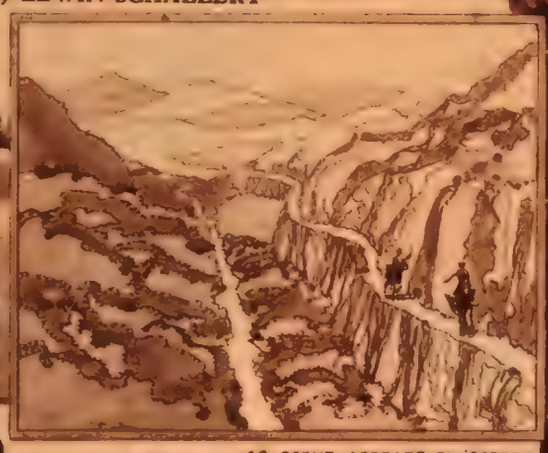
The combination safety bag and stretcher invented by W. H. Blake of the Los Angeles Fire Department rescue squad, is shown being demonstrated in the photos above and at the left. Injured persons can be handled expeditiously

The photo below: instruments that are used in imitating the Midnight Express for radio listeners to station WGY. They consist of a whistle, a bell, a flour sieve, roller skates and two boards covered with sandpaper.

The machine illustrated in the photograph below is supposed to be a perpetual motion machine and, according to its inventor, Herman Pleith, of Germany, it actually works. This publication offers $5,000.00 for the privilege of examining such a working model.

How "Kid Boots" Was Filmed

By EDWIN SCHALLERT

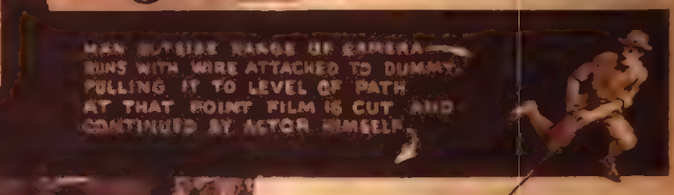


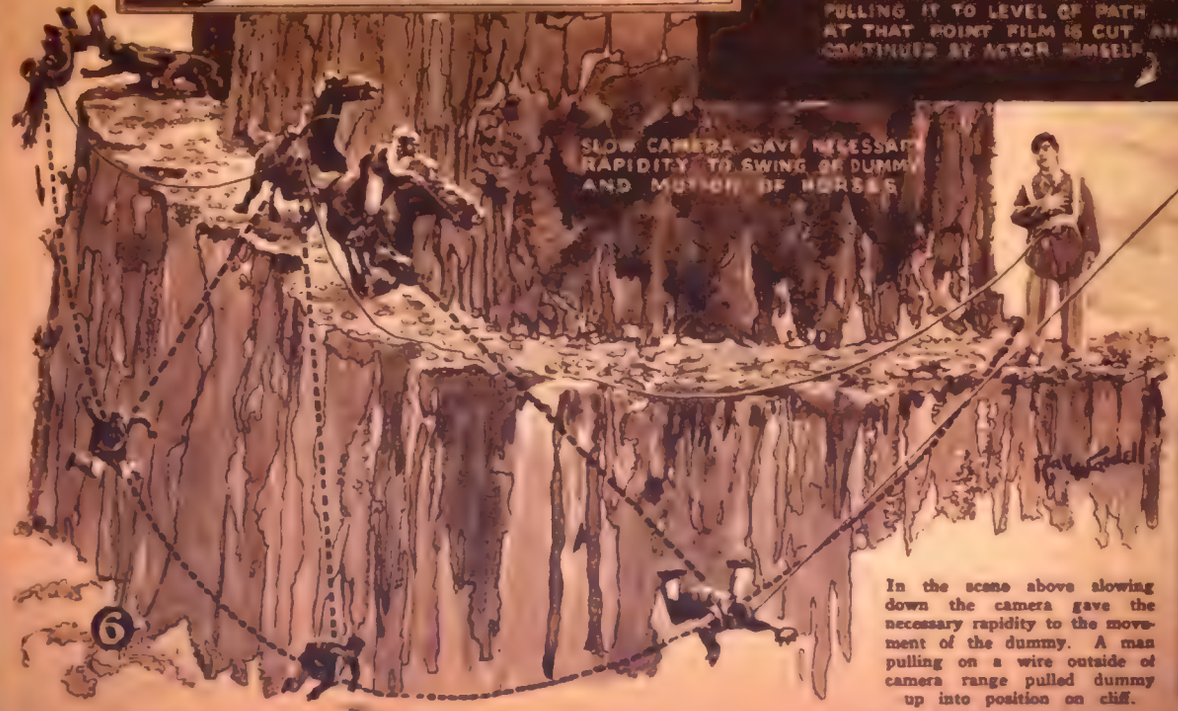
AS SCENE APPEARS ON SCREEN AND ---- AS IT WAS TAKEN

In one part of the picture, the appearance of riding on a very narrow cliff was obtained by focusing the camera on the riders through a clear space on the painted glass.

CANTOR FALLS — AS ACTUALLY DONE BY TRICK RIDER — AND THE EFFECT ON SCREEN OBTAINED BY SLOWING CAMERA

A "stunt" rider falling off a slowly moving horse and the camera slowed up while the pictures were taken produces a lively action scene.


MAN OUTSIDE RANGE OF CAMERA RUNS WITH WIRE ATTACHED TO DUMMY, PULLING IT TO LEVEL OF PATH AT THAT POINT FILM IS CUT AND CONTINUED BY ACTOR HIMSELF



The illustration at the left shows the way the scene of Eddie swinging across the face of the cliff was photographed. The horse was halted outside of the camera range, the dummy was given a good swing and then the horse slowly trotted forward.

In the scene above slowing down the camera gave the necessary rapidity to the movement of the dummy. A man pulling on a wire outside of camera range pulled dummy up into position on cliff.

Picture at left shows mountain and valley where exciting scenes of "Kid Boots," featuring Eddie Cantor, were taken. There are many exciting moments, as the pictures at right and below will testify.

THE LOCATION ON LOOKOUT MT. NEAR HOLLYWOOD

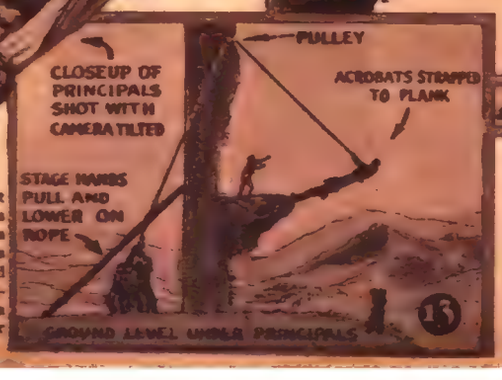
Suspended actors are close to ground.

Actor is short distance above ground in this scene.

At right: shows exciting moment when Eddie Cantor attempts to walk along a log. Left end of log catches in ledge. It is a short distance above ground.

Picture at left shows exciting moment in "Kid Boots," featuring Eddie Cantor, when Mr. Cantor is apparently hanging above deep valley, with merely a thin rope between him and Eternity. Views at top and bottom of page show how scenes on this projection were taken with safety to the actors. Panoramas of the valley completely fools one.

In Fig. 14, at right, the moment when the rock projection breaks loose is shown. The actors appear at the start of this part of the picture, the false rock being a short distance above terra firma. Below: Comical moment in picture when Mr. Cantor sways up and down on shoulders of another actor. Fig. 13 below shows how this was done by passing rope over pulley, with group of men pulling slowly up and down on free end of rope. In many of the scenes similar to this, nets are placed under the projection, etc.


PULLEY
CLOSEUP OF PRINCIPALS SHOT WITH CAMERA TILTED
ACROBATS STRAPPED TO PLANK
STAGE HANDS PULL AND LOWER ON ROPE
13
GROUND LEVEL UNDER PRINCIPALS

Picture at right shows how one of the most ludicrous moments in "Kid Boots" was photographed by the aid of a rope and pulley together with a group of men.

©1927 BY SCIENCE AND INVENTION

Long shots of parachute falling with "actors" after rock broke loose; made with dummies tied to parachute, interspersed with closeups of principals clinging to parachute, et cetera.

MADE WITH DUMMIES, INTERSPERSED WITH CLOSEUPS OF PRINCIPALS CLINGING TO PARACHUTE, ROLLING DOWN ROOF, ETC.

Into the Fourth Dimension

SIXTH INSTALLMENT

First American and Canadian Serial Rights

By RAY CUMMINGS

Again, close at hand, just beyond the village of globes, was an enclosure possibly a thousand feet across. Movement was there—busy workers moving in the artificial glow of strings of lights. Vague, shifting shadows—grey shapes of men, from which the lights cast monstrous grey shadows as they moved. It seemed a dim inferno of strange industry incomprehensible. . . Brutar led us toward it.

Synopsis

Robert Manse, a correspondent in the New York Office of a Latin-American export house, in company with Willon Grant and his sister Beatrice, saw the first of the ghosts in February, 1946, a few miles from Rutland, Vermont. These ghosts were semi-transparent, glowing figures much resembling human beings. Attempts to destroy them with bullets or clubs had no effect on the shadows. Passing the hand through the space occupied by one of these ghosts produced no tangible sensation. Later, the ghosts became more bold and more numerous, even molesting human beings and causing at least one death in Kansas, the result of heart failure induced by the fright of encounter.

Some time later, Will calls Rob on the telephone, saying that his sister Bee is quite ill and asking Rob to pay them a visit. During the visit Will mentions that the ghosts have already arrived in the Borderland lying between their world and ours, and that they were on the point of coming into our world. Will himself has discovered a means of entering into this borderland, and declares that even though he is being watched by many of the ghosts he will make an attempt to-night to enter their realm and turn the spirit-like creatures back into their former paths. While he makes the journey, Rob is to stay behind with Will's sister, Beatrice.

The preparations for the experiment are made, and Will clasps upon his arm a connection to the vibration-transformer which, by altering the vibrations of his body, is to transform it from normal substance to the wraith-like material of the other world. They see a ghostly form watching them as Will's body becomes transparent, but finally the apparatus is disconnected and they wait for his return. Five hours later, Will returns saying that they must go back with him to save the world from an invasion of the ghostly hordes.

Robert and Beatrice, though face-to-face with the unknown, succeed in suppressing their fear, and agree to accompany Will across the border. The three adventurers don their metallic garments, attach the batteries, and swallow the acrid compound which is to transform their tissues. In a few minutes they find themselves transposed into the Borderland.

They meet Ahla who takes them to the big city. The triplet is told that Brutar is inducing his followers to enter our world. A battle of thoughts takes place among the ghosts. Brutar captures Rob and Bee with thought waves, and tells them that he can use them for his conquest of the earth. Will and Ahla go to the rescue.

Now continue with the story.

CHAPTER XII

THE ENCAMPMENT IN THE VOID

BRUTAR said, "Let us go in here. I want to talk to you."

We entered a globe very much like those of the Big-City. And reclined at physical ease. But there was no mental peace here—for us at any rate. A turgid aura of restlessness seemed pervading everything.

Brutar rested before us. He seemed always to be regarding Bee; contemplatively, yet with a satisfied triumph.

"I am glad to have you with us," he said; not harshly now, rather with an ingratiating note as though he sought our good will. "We are going to your Earth—to live there, and they tell me, these good people of mine, that they are going to make me its ruler."

He spoke with a false modesty, as though to impress us with his greatness forced upon him by his adoring followers. "I want you two for my friends—you will be of great help to me."

"How?" I demanded.

I had recovered from my confusion. I was wary; the thought came to me that I might be able to trick this Brutar—that being here with him—to see and feel what he was doing—was an advantage which later on I could turn to account. I wondered if he could hear or feel that thought. I willed it otherwise; and it seemed that he could not. His eyes were upon me, gauging me.

"How could we help you?" I repeated. "And why should we? You mean harm to our world."

"No," he protested. "No harm. We have selected it—your Earth—from all that great Universe of yours which I have inspected. We want to go to your Earth to live. That is all. You can help me, because you know so many things of Earth that I do not. I want you to tell me of them . . . Stand up!"

I found myself upright, whether by my own volition or his I cannot say.

"Stand up, Bee!"

At his command she also stood erect. He came to us; his hands went to the belts we wore about our waists. I had forgotten my belt—those things in its pouches which Will had bade me not touch. Brutar took them now—my weapons perhaps. And those which Bee carried; took them, discarded them behind him. They floated away; I could barely see them—small formless blobs to my uncomprehending thoughts.

I had very nearly resisted Brutar; but it seemed a futile thing, and I stood quiet. Again we reclined. "Tell me of your Earth," he said; and began to question me.

I told him what I could. I had determined that my best plan was to appear friendly. I wondered how one would escape from a place like this. I was more accustomed to this strange state of being now; knowledge which seemed instinctive was growing within me. I knew that if Brutar's net of thoughts were not to hold me—if I could momentarily be freed of other thought-matter—then I could project myself out into the void. I believed I could find my way back to the Big-City—once having been there I would have the power to return.

This latter knowledge brought with it a thrill of triumph. I believed that Will and Thone had never been here in Brutar's strong-hold. Perhaps this was a secret place which they could not find. But now I had been here; and if I could escape, I could lead others back to it.

With these guarded thoughts surreptitiously roaming through my mind, I was all the while describing our Earth to Brutar. He interrupted me once. "Eo, come here."

I became aware of another shape hovering near us. It now advanced; and with Brutar's words of explanation it took form in the fashion of a young man. A smiling, deferential youth seemingly of an age just reaching maturity. He came forward meekly. Brutar spoke.

"THIS is my friend whom we call Eo. I have great trust in him—he is helping me greatly. I want him to hear what you have to say, Rob."

Eo smiled again. "I hope we shall be friends." He regarded Bee, and his smile was curiously gentle. "They call you a girl? Brutar tells me what girls are—I am glad to see you."

He reclined beside Bee, continuing to regard her. A very gentle, guileless youth—how queer a companion for this Brutar! And I knew then that it was gentle beings like this whom Brutar was beguiling to his purpose.

Brutar said, "Go on, Rob. What you can tell us will be very interesting."

Particularly he questioned me about our physical bodies of Earth—the human body; and when I told him how mortal it was, how easily injured, he seemed disturbed. But only for a moment.

"I have been—well, very nearly in your Earth-state," he said. "I know how it feels. You have things with which to harm that body. Weapons—tell me of them."

I described our weapons; our warfare. Our poisons. I will admit it gave me a gloating pleasure grewsomely to picture all the dangers to which our mortal flesh is heir. But outwardly he was undisturbed. He interrupted me once with a sharp admonition to Bee.

"You think you can send your thoughts back to the Big-City and guide them here, don't you? I would not try that, if I were you!"

Bee started with guilt. She had been attempting to do that. Her thoughts had gone back, at first instinctively, then with a conscious direction, but he was stopping her now. Around us like a veil a barrier was materializing.

Eo said gently, "She will not do that, Brutar. She is friendly to us." His hand very lightly touched Bee. He added earnestly, "I like you—girl."

Brutar momentarily had turned away; I think he was not aware of what Eo had said. I saw that Bee was smiling. I felt her voice saying very gently.

"I like you, too. You are very kind—I think you are very good. On Earth we would call you—a boy."

"Boy!" He murmured it. "I like the way that sounds—hearing you call me—boy!"

Brutar had risen erect. "You have told me a great deal, Rob. We shall be friends." He was eyeing me. "On Earth, when we get there, I shall make you into a great man—a very powerful man. You would like that?"

Did he feel that my intelligence was so limited that he could bribe me thus crudely? I smiled.

"Oh, yes—I should like that. But I've told you so much, and you haven't told me anything. How did you first find our Earth? How did you get yourself into that Borderland, and beyond? You were the first to go, weren't you?"

"The first," he said proudly. "I discovered it—well, by accident. Shall I show you how? And what I am doing to take all my loyal followers there with me?"

"Yes," I agreed. "That is what I want."

He led us outside. Eo walked close by Bee. I saw now that the encampment was itself one tremendous hollow globe; on Earth we would have said that it had a diameter of at least a mile. Brutar explained is proudly. Here, in the void of Space, his organized workmen had spun this huge shell of thought-matter. It was tenuous; I had not known when we passed though it coming in. Yet it was visible; within it we gazed at its interior surface. It glowed with a very pale dull light.

Upon this concave slope, in the foreground near us, were a variety of globes—small habitations for the workers. Paths ran between and over them. Further away, other larger globes glowed as though translucent, with light inside. Beyond them was a shimmering white lake—water or mist. Higher up—in the distance where the concave surface extended upward and swept back over our heads—was what seemed like dark soil. Things were growing there in orderly rows—a gigantic concave field of plants. It was dim off there, and so far above us that I could not make them out plainly.

Again, close at hand, just beyond the village of globes, was an enclosure possibly a thousand feet across. Movement was there—busy workers moving in the artificial glow of strings of lights. Vague, shifting shadows—grey shapes of men, from which the lights cast monstrous grey shadows as they moved. It seemed a dim inferno of strange industry incomprehensible . . . Brutar led us toward it.

"We built all this," he said; and his gesture encompassed the entire inner void within that glowing tenuous shell. "We built and poised this here in Space. My followers have forsaken their homes to join me here. Soon we will go to your Earth-realm. . . Some of us often go out there now—into that Borderland—to test our power."

The enclosure had a wall about it—a thick high wall built of a grey substance lying in layers, folded in convolutions. We stood upon the wall, gazing at the scene within.

"I would not have you see too much—now," Brutar said.

A cunning look was on his face. "Not—too much, until we are better friends and I can be sure of your loyalty."

The lights were dazzling when near at hand—yet their rays carried but a little distance. I saw in the foreground beneath us, a section where men were squatting one behind the other in a long curved line. Their backs were bent forward, with heads and necks unnaturally held upright. Their arms and hands were outstretched in a curious attitude as with supplication. There must have been two hundred of the men, squatting in this single line which curved in a crescent until its end was near its beginning. They were men with bodies which seemed shrunken; their arms and hands very long; thin, tenuous. But their heads were overlarge; distorted to a swollen size.

Brutar said softly, "Now—in a moment—watch them."

A leader, raised above these squatting, motionless workmen, gave a signal. From the head of the man at the back of the line a pallid light seemed streaming. It was very faint—a glow of pale white light, no more. But as I stared, breathless, I saw that it was not exactly like light, but a stream of something moving. Very faint; a fog, a mist, which a sweep of the hand might dissipate.

It streamed forward; and as it passed the head of the next man, there seemed additional light adding to it. Both men had their hands up, as though to guide the stream—gently to guide that which must have been very nearly impalpable.

But it was growing in density. Soon, further up the line with every brain contributing a share, the slowly moving stream began to have substance. From vague, luminous pallidness, it turned darker; gaining a solidity—a weight. The guiding hands sustained it, moulded it, pushed it onward.

(*Continued on page* 939)

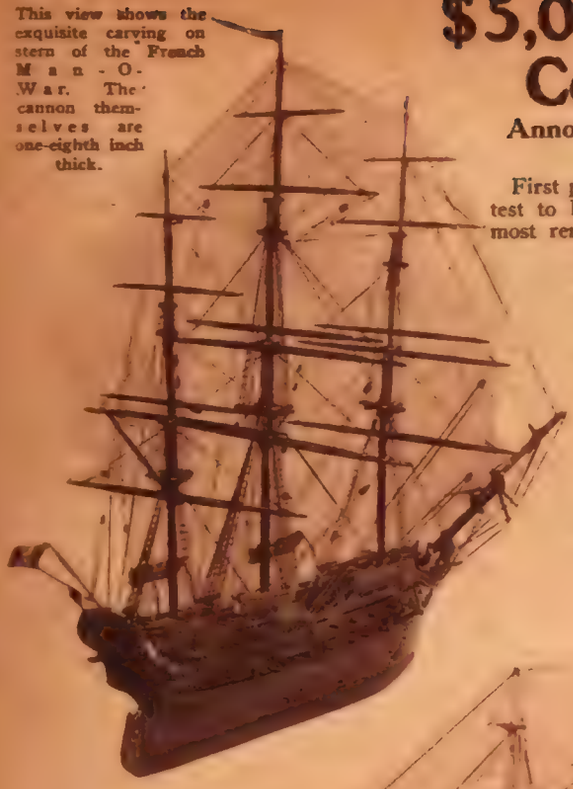
I saw in the foreground beneath us, a section where men were squatting one behind the other in a long curved line. Their backs were bent forward, with heads and necks unnaturally held upright. Their arms and hands were outstretched in a curious attitude as with supplication. There must have been two hundred of the men, squatting in this single line, which curved in a crescent until its end was near its beginning.

$5,000.00 Matchcraft Contest Awards

Announcement of the Last Group of Prize Winners

First prize—$100.00 is awarded in the December contest to Raphael Guéril of Brooklyn, N. Y., for the most remarkable example of Matchcraft skill which has as yet been produced. It represents a French Man-O-War, equipped with 44 cannon, lifeboats, stairways, ship's bell, anchors and, in fact, all of the trimming found on the actual vessel. It would appear that not the slightest detail from the handsome carving on the bow to the rib construction of the vessel has been omitted. Mr. Guéril, a printer by trade, worked two and one-half months on this model.

This view shows the exquisite carving on stern of the French Man-O-War. The cannon themselves are one-eighth inch thick.



Miss Olga Silvay is shown holding the first prize-winning model in the $5,000.00 Matchcraft Contest, which will, until further notice, offer prizes of $100.00 a month. An example of the size of the ship can be obtained from this photograph. It is 16 inches long and 12 inches high and mounted on a Matchcraft base of artistic design. Even the flags are of matches.

This photograph shows the side view of the first prize-winning model. Note how detailed is the construction of the timbers of the hull.

The photo at the right gives us an airplane view of the first prize-winning model. Isn't this maze of ropes inspiring? The height of the vessel from the tip of the mast to the keel is 12 inches.

$100.00 Monthly Prize "Matchcraft" Contest

DURING the past year SCIENCE AND INVENTION Magazine awarded $5000.00 for articles made entirely of matches. While this $5000.00 contest has officially expired, the publishers have decided that because of the great popularity in Matchcraft constructions, the contest would continue in force on a new prize rate basis until further notice. The list of new prizes will be found in the center box and the same rules for the first contest are to be observed in this contest.

(1) Models submitted must contain at least 90 per cent. safety matches in their construction.

(2) Models made of toothpicks, paper matches, or non-safety matches, are not eligible in this contest.

(3) Models can not be built around boxes or other supporting articles. Walls, roofs, etc., must all be self-supporting and made of matches.

(4) All liquid adhesives, such as glue, shellac, cements, etc., are permissible.

(5) Models may be painted, gilded or silvered.

(6) Models may be of any size.

(7) In order to win a prize, it is necessary that either models be submitted, or, if this is not practical, owing to their size, a 5"x7" photograph of the model may be sent in lieu of the model itself. The best models submitted each month will be awarded the prizes scheduled herewith.

(8) All models submitted to SCIENCE AND INVENTION Magazine will be promptly returned to the builder, who will prepay all charges.

PRIZE AWARDS

First Prize	$50.00
Second Prize	20.00
Third Prize	15.00
Fourth Prize	10.00
Fifth Prize	5.00
Total	$100.00

(9) Where SCIENCE AND INVENTION has any doubts as to the model (where photos only are submitted) complying with all the regulations, the judges may, at their discretion, request that the actual model be sent in for inspection, paying transportation charges both ways.

This is a monthly contest and will continue until further notice. Each monthly contest closes on the first of the month following date of issue. Thus the contest for the month of February will close March 1st and prize-winning announcements will be made in the May, 1927 issue.

(11) Models must be shipped in a strong wooden box, never in a cardboard box, as SCIENCE AND INVENTION can not be held responsible for breakage in transit due to models having been improperly packed.

(12) When models are sent, be sure to affix tag, giving your name and address, to the model itself. In addition, put name and address on outside wrapper of package.

(13) Address all letters, packages, etc., to Editor, "Matchcraft" Contest, care SCIENCE AND INVENTION Magazine, 53 Park Place, New York.

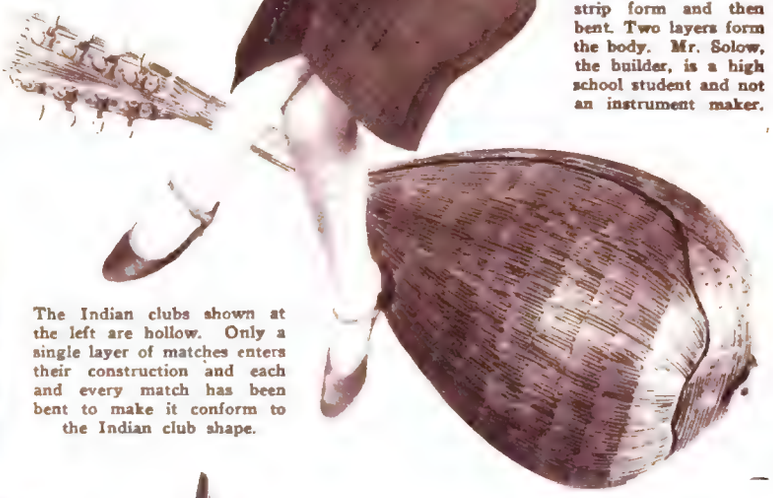
Caution—Soak or cut heads from matches before building your model so that the models may be expressed or mailed. The strike-everywhere square cut Liberty matches can be used if the heads are cut off.

SCIENCE AND INVENTION has awarded $5,000.00 in prizes for constructions made entirely of matches during the past year. Awards on these pages complete the list of prize-winners for the year 1926.

Second Prize—$75.00. The photograph at the left shows Miss Peggy Griffin swinging the Indian clubs which won the second prize. They were made by Eugene Jefferies of Anacortes, Wash.

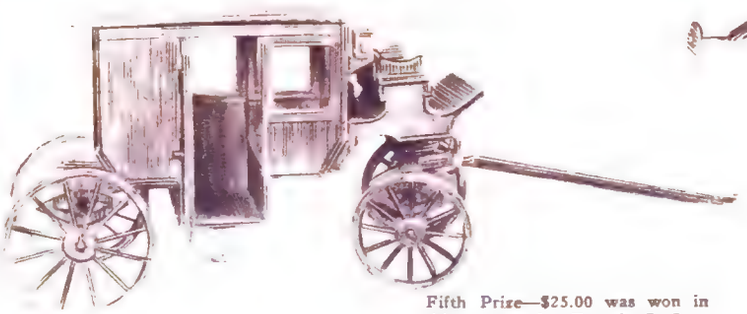
The Indian clubs shown at the left are hollow. Only a single layer of matches enters their construction and each and every match has been bent to make it conform to the Indian club shape.

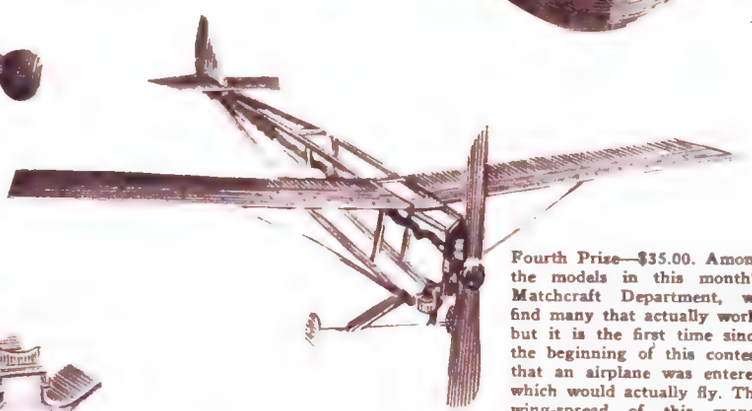
Third Prize — $50.00 was awarded in this contest to Oscar Solow, of New York City, for the mandolin, being played in this photograph by Miss Rose Bloomberg.



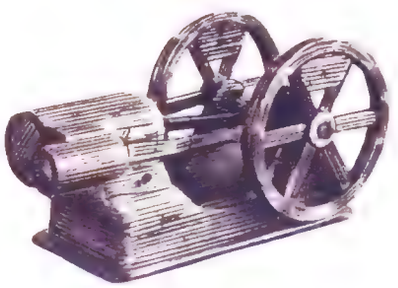
The photograph below shows the body of the mandolin to advantage. The matches were glued together in strip form and then bent. Two layers form the body. Mr. Solow, the builder, is a high school student and not an instrument maker.

Sixth Prize—$20.00. Here is a splendid example of the cabinet-maker's art showing a clear perception of historic vehicular construction. The stage coach, provided with glass windows, springs, seats, etc., was built by Carl Fichtner of Philadelphia. The wheel base is 12 inches. The model is sandpapered smooth.

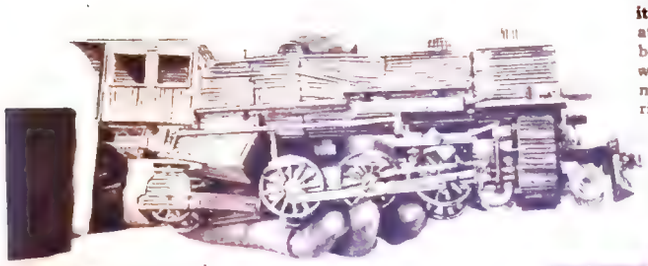




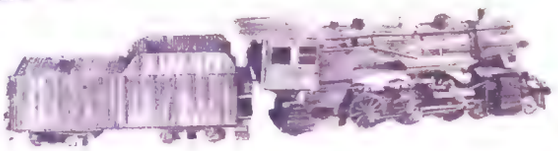
Fourth Prize—$35.00. Among the models in this month's Matchcraft Department, we find many that actually work, but it is the first time since the beginning of this contest that an airplane was entered which would actually fly. The wing-spread of this monoplane is 31 inches. The matches for the wings were sandpapered to make them very thin. The model was built by William Ryan of St. Petersburg, Fla.



Fifth Prize—$25.00 was won in this contest by Francis J. Lorenz of Sayre, Pa., for his model of a horizontal steam engine. This engine is so well made that it does not require steam to operate it. Blowing through a rubber hose will cause the engine to work. It is single acting and the momentum of the fly-wheel carries it around to the next power stroke.



Eighth Prize—$12.50 was won by Harry Erno of Ogdensburg, N. Y., for the locomotive shown in the photograph above and also in the photo at the right. This locomotive is complete in every detail and provided with automatic couplers, reversing gear and the other incidentals found in such a device. Compare it with the hand holding it.



Mr. Erno won the first prize in one of the previous contests with a much larger locomotive.

The Matchcraft Contest is to be continued until further notice with a new schedule of prizes. The rules may be found on the previous page.

Further Matchcraft Awards

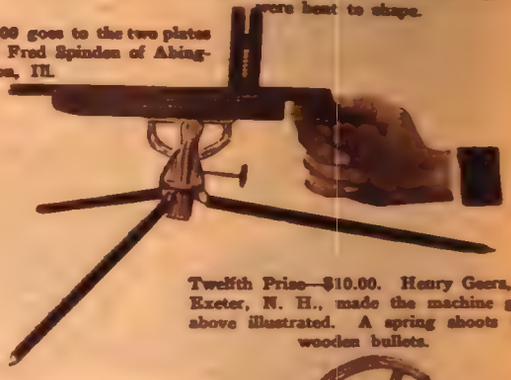
Ninth Prize—$10.00 was won by C. R. Goldberger of Brooklyn, N. Y., for his model of an ancient Man-O-War, the hull of which is 18 inches long. The sails are also made of matches.

Seventh Prize—$15.00 goes to the two plates and saucer made by Fred Spinden of Abingdon, Ill.

Miss Anna D. Giovanni with the seventh prize-winning idea.

All the matches for the above articles were heat to shape.

Tenth Prize—$10.00 was awarded to the Ferris Wheel design here illustrated and built by Julius Glaser of New York City.



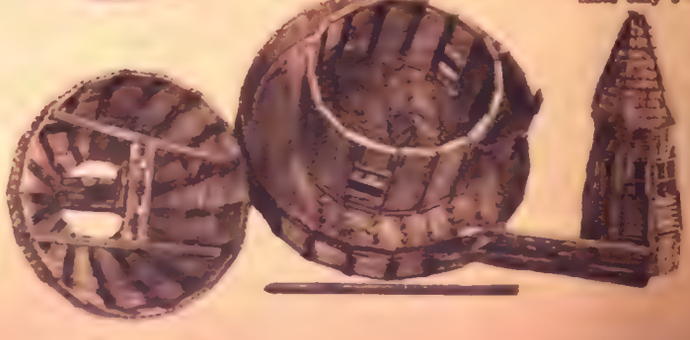
Twelfth Prize—$10.00. Henry Geers, of Exeter, N. H., made the machine gun above illustrated. A spring shoots the wooden bullets.

Sixteenth Prize—$10.00. Here we have an example of a double-acting steam engine which will actually work and which was built for the Matchcraft Contest by Lester Thomas, of Chester, Pa. The cylinders were made impervious to air by paraffin.

Eleventh Prize—$10.00 was won by Keith Barnes of Williston, N. D., for his model of a SCIENCE AND INVENTION trophy cup. Note how matches are bent.

Fifteenth Prize—$10.00 was won by L. Terwilliger of Ashland, Ore., for the extension table only 5 inches long when closed.

Thirteenth Prize — $10.00. Volney N. Phillips of the Climax Mine at Jackson, Calif., sends this Matchcraft construction with the designation that it is a California gold quartz mill. The mechanism actually works.



Fourteenth Prize—$10.00. The construction, entitled a Burmese Temple, was made by Eugene Gayle of Brooklyn, N. Y. This temple is 24 inches high and 15 inches wide at its base. Thousands of matches entered its construction and these were all glued together in the form of shingles and then laid on a framework also composed of matches. The entire object may be taken apart.

The Matchcraft Contest has not discontinued. The list of prize awards has been changed. You can still submit your models. See contest rules on page 902.

The Doctor took pains to emphasize that my fingertips had never left the slate and it was quite impossible for anyone to touch the lower side of the slate without disturbing either my fingers or the chair . . . A long message had been legibly written by the mysterious unknown force.

Our Spiritualistic Investigations

NO. 7 OF A SERIES

By Dunninger.

IT was in Washington, D. C. I was appearing at the B. F. Keith Theatre, and had just completed my performance. Mr. A. Frank Jones, my personal representative, informed me that he had received several phone calls during the afternoon from a gentleman, who identified himself as Dr. Frederick D. Bowers. Presenting, as I do, a vaudeville mindreading specialty, phone calls came fast and plenty throughout the week. In spite of the fact that I took great pains in emphasizing that I did no fortune telling, it seems that there were many who would not accept this admission, and were thus persistant in seeking information about some friend, relative, or other. There is the young girl who insists upon knowing whether or not her affection is returned, the inventor who would know the outcome of his product, the woman with the lost jewelry, or stolen purse. All these, and many more, seem opposed to accepting my frank admission as to my absence of supernatural power, and thus persist in learning something from the land of the unknown to aid them in their numerous difficulties. Two performances daily, and a volume of publicity work, quite essential to my specialty, leave their mark, and I therefore long ago learned the necessity of reserving my vitality. Desirous as I am to inform these many mystery seekers, that such psychic advice does not exist, I find it necessary to shift this burden of my responsibility, upon the shoulders of my representative, as to answering their questions. He makes it his duty to enlighten many of these misinformed subjects, daily. And so it happened that I was not informed of the persistant phone calls of Dr. Bowers, which continued until late in the evening. I was removing the greasepaint from my face, and listened intensely to the details of a most interesting conversation that had transpired over the wire between the spiritual wizard, and Mr. Jones.

Dr. Bowers, I was told, professed to be a student of spiritual phenomena, and was an exponent of the occult. He had heard of the $21,000 offer, made by SCIENCE AND INVENTION Magazine, and felt that he was a contestant for the prize. The medium, I was told, however, emphasized that he would be willing to offer evidence of his extraordinary ability in my dressing room at the theatre, in order to prove to me that his manifestation was genuine. He had gone over lengthly explanations, descriptive of his wonderous work, and had mentioned a great number of names of prominent investigators, whom he claimed to have mystified in the past several years.

My conversation was shortly interrupted, when the theatre doorman tapped upon the dressing room door. The uniformed attendant announced a gentleman in the blue-room, who desired an audience with Mr. Dunninger. In the customary way, my business associate quickly left the room to meet the visitor. During his absence, I proceeded to change from my evening dress to a business suit, and had not entirely completed my change, when Mr. Jones re-entered the room, and presented Dr. Frederick Bowers. After the usual exchange of greetings, and after Mr. Bowers had been seated in a comfortable chair, my representative explained that he had tried to persuade the "Dr." to make a later appointment, inasmuch as my professional day had been an unusually trying one, but had failed to arrange a later appointment, because the "Dr." was leaving for Chicago the following morning, and could not possibly arrange a later appointment. Interested as I was in the description of the medium's work, and the prominence

(*Continued on page* 952)

$21,000.00 for Spirits

Dunninger, who writes exclusively for SCIENCE AND INVENTION Magazine and who is the Chairman of our PSYCHICAL INVESTIGATION Committee will personally pay $10,000.00 to any medium or spiritualist who can present any psychical manifestation in so-called spiritualism, that he will not explain or that he cannot reproduce by natural means.

More than two years ago SCIENCE AND INVENTION Magazine offered a prize of $11,000.00 to anyone who could demonstrate his or her ability to communicate with the spirits or to give some definite form of a psychical demonstration which in itself was not trickery.

The result has been that mediums and spiritual organizations have been afraid to place proofs before us. Those weak attempts which have been made to demonstrate psychical phenomena were almost instantly proven fraudulent, and no medium has dared to contradict our findings.

In view of these facts, should we not consider all mediums fraudulent?

To the $10,000.00 which has been offered by Joseph F. Rinn through this publication for Spiritual proofs and the $1,000.00 in addition offered by SCIENCE AND INVENTION Magazine we now add Dunninger's $10,000.00.

So now we have a total of $21,000.00 offered for proofs of Psychical Manifestations. Spiritualists—get busy.

New Ideas at German Exposition

An exhibition of the latest German inventions, held recently at the Merkurhaus, Berlin, presented many new toys. One of the most ingenious was the trotting horse illustrated at the left, which is actuated by a mechanism concealed in the body. The motion is caused by pulling upon the reins while seated in the sulky. The machine goes about 3 miles an hour.

Above, one of the many wheeled toys which were on view. A propeller turns realistically as the pilot pedals along. At right, another variation of the automatic horse illustrated above, where the rider sits upon the back of the horse and bounces up and down as if posting to a trot.

Above, a universal tool which may be used as a hoe, a spade, or a shovel. Beside it is seen another garden tool which mows grass and pulls weeds without wasting time or muscular energy. At left, baby's toys are suspended from elastic bands within his reach. This assortment should furnish him amusement for some time. At the right, another of the numerous airplane toys. The miniature plane is sent into the air by a special mechanism. A cord trails from it which is pulled to release a parachute as shown in the photograph. We are unable to give the names of the makers of these toys as the information was not given.

The latest thing in winter shoes is the pair illustrated here, where muffs are provided to keep the ankles warm in wintry winds. Below, a compact motorist's or aviator's toilet kit which contains water and all the necessary accessories. This should appeal particularly to touring motorists.

At left, an electric power unit which may be used to shift carts and baggage trucks with ease. At right, an extremely unique toy. The butler removes the coat and hat of the entering guest and the attendant conducts him into the house. The mechanism is entirely automatic and is ingeniously planned.

MAGIC By "DUNNINGER"

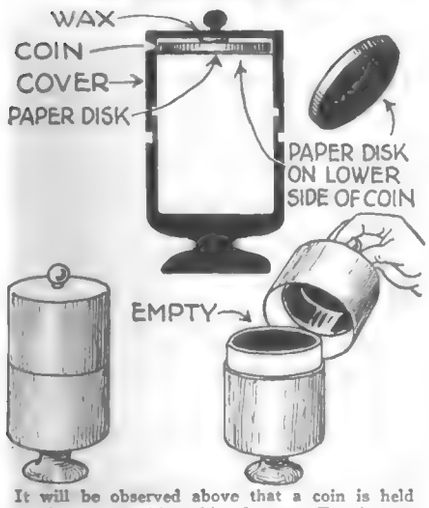
HIPPODROME Tonight
DUNNINGER
DUNNINGER ANALYZES TRUBINE EMPLOYEES IN DEMONSTRATION
Joe Dunninger Tells How Prince Got Trick to Show Home Folks
DUNNINGER
HYPNOTIST RULES SUBJECT BY RADIO
Reads Mayor's Inner Mind

THE MAN WHO MYSTIFIED
Pres. Coolidge
Prince of Wales, Ex-President Harding, Taft, Roosevelt, and other celebrities
Writes Exclusively for
SCIENCE AND INVENTION

Folks Are Mystified Yet Delighted by This Man!
Mind You! The Mind Reader Really Read the Mayor's Mind
DUNNINGER DRAWS HUGE BIG CROWDS
Dunninger Will Attempt To Hypnotize Patient, 10 Miles Away, by Radio

NO. 47 OF A SERIES

A New Coin Box

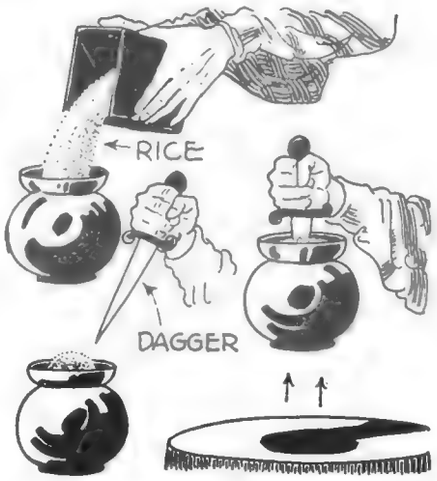


It will be observed above that a coin is held to the cover with a bit of wax. The bottom of the coin is concealed by a disk of black paper. A second coin is vanished and apparently made to appear in the box.

THIS is an excellent parlor trick, absolutely new in principle, and has not yet appeared in its present form either in another book or on the market. A small box similar to the one in the illustration above has an inside diameter slightly larger than either a silver half-dollar or a dollar. The coin is covered on one side with a piece of black paper and then held in position by a pellet of wax. The inside of the box itself is painted a dull black. A duplicate coin is made to disappear by any of the regular methods and is found to appear in the box. Setting the box down sharply on the table releases the coin.

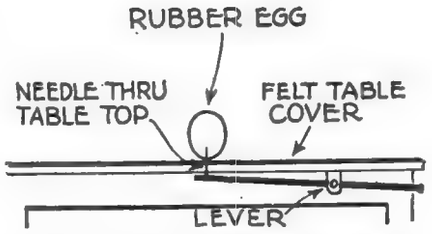
Hindu Rice Trick

HERE is a spectacular mystery credited to the wise men of the East. A brass bowl is displayed and passed for examination. A bag of rice is also shown and likewise examined and, lastly, a shining dagger is thoroughly inspected. The Orientalist pours the rice into the jar, inserts the dagger into the center of the rice and lifts both rice and bowl, using the dagger as a handle. Immediately thereafter everything is passed for examination. When pouring the rice into the bowl, the jar is tapped, causing the rice to adhere firmly to the sides of the jar and producing a very hard gripping filling, which will firmly hold the knife.



A bowl full of rice may be raised from the table if a dagger is plunged into the rice previously firmly packed in the bowl.

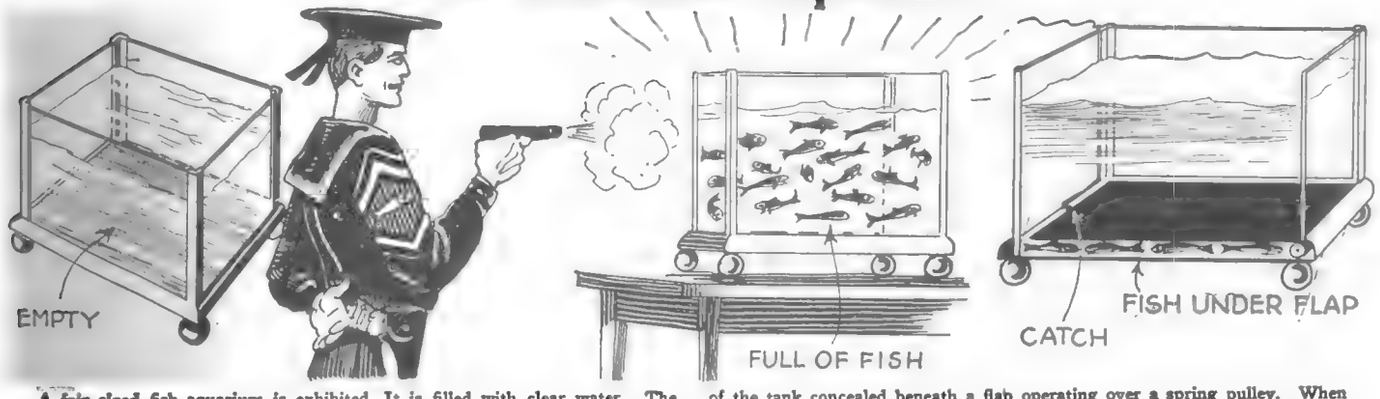
Columbus Outdone



A rubber egg may be balanced on the surface of the magician's table if the table has been provided with a lever and needle as this illustration clearly shows.

THE readers will undoubtedly remember the story of Columbus and the egg. This discoverer must undoubtedly have been an amateur conjurer otherwise nothing would have induced him to show this trick to the Queen of Spain. He found it necessary, however, to break the shell to balance the egg. In this stunt a rubber egg is used, which can neither be broken nor balanced, except by the magician. He is able to accomplish this by the aid of a lever, to which is secured a needle point, as indicated in the diagram above. The lever is operated by hand.

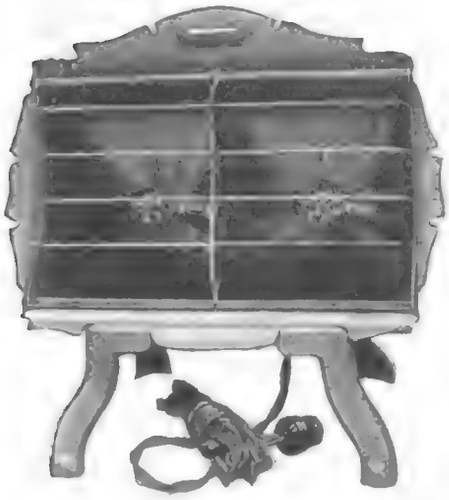
The Enchanted Aquarium



A fair sized fish aquarium is exhibited. It is filled with clear water. The magician standing at a distance loads a pistol with fish eggs, fires at the tank, and instantaneously it will be found to be filled with hundreds of fish swimming happily about. This effect is very impressive upon an audience. It is one of the few which can be presented without covering the tank with any cloth. The fish themselves are found in the bottom of the tank concealed beneath a flap operating over a spring pulley. When the shot is fired, a string releasing the catch is pulled. The noise of the shot drowns the sound of the movement of the flap. Several large fish and a great many smaller fish are held in the bottom of the aquarium. They are kept alive by a sufficient quantity of water, which just reaches the bottom of the roller blind-like arrangement.

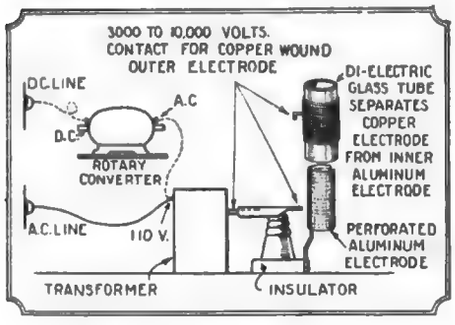
New York Electric Show

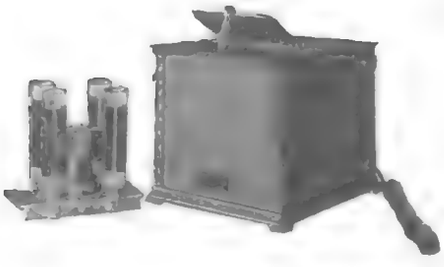
RADIANT HEATER

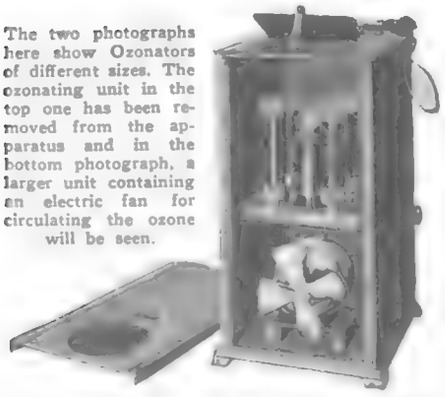


Here we have a 660-watt heater provided with two heating elements and two compound quadruple reflectors, intended to concentrate some of the heat developed by the device on definite spots in the room. The heated area is greatly increased with this type of reflector.—Photo courtesy Magnavox Co.

OZONATOR







The two photographs here show Ozonators of different sizes. The ozonating unit in the top one has been removed from the apparatus and in the bottom photograph, a larger unit containing an electric fan for circulating the ozone will be seen.

Ozone is formed by a silent electrical discharge passing between the perforated aluminum electrode and the wire winding on the dielectric glass tube. Both electrodes are connected to opposite sides of a high voltage transformer. Ozone will rid your kitchen and any other room of odors.—Stadstad, Hittinger & Stants, Inc.

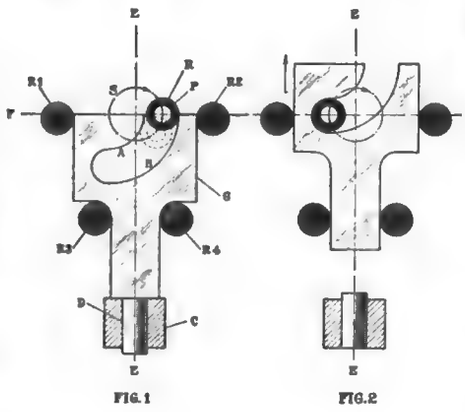


FIG. 1 FIG. 2

ELECTRIC HAMMER

The above two figures show how the electric hammer is operated. R is a roller which lifts the hammer, G, along three-quarters of its circuit, S. G slides between guide rollers, R, striking E.

The above photo shows the electric hammer in operation. It weighs 10 pounds, is operated by a 1/6th horsepower motor, and delivers 2,400 blows per minute. The diagrams below show the last two stages of the cam movement and of the hammer itself.—Ajax Electric Hammer Corp.

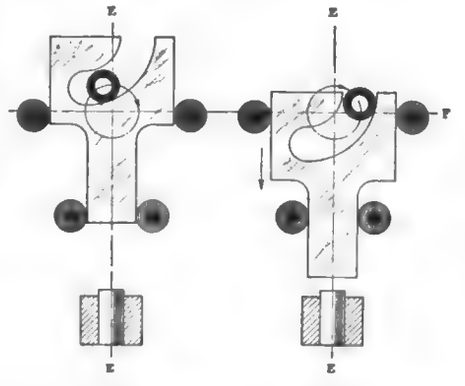
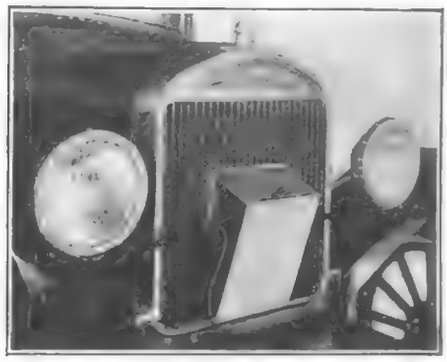


FIG. 3 FIG. 4

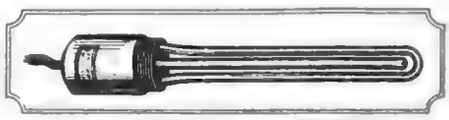


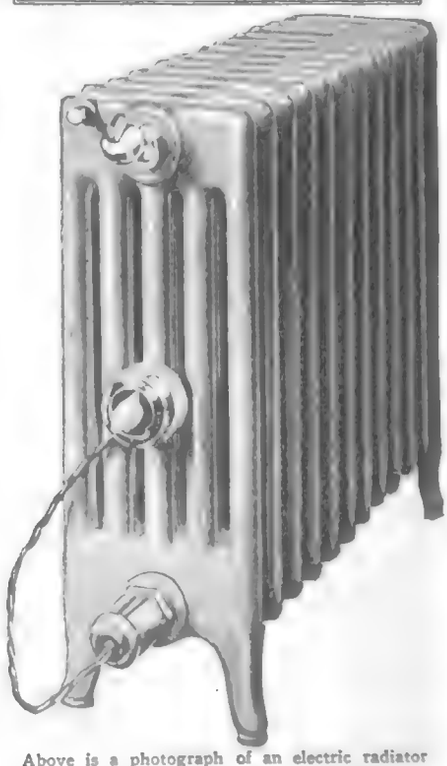
RADIATOR HEATER

The above photograph shows a new style of automobile radiator heater which may be hooked on the rod as indicated in the photo above or may be slipped behind the front bumper. It heats the radiator effectively.

ELECTRIC RADIATOR

The device attaches to a regular light socket, consumes 225 watts, is made like a miner's lamp and circulates the air by convection.—R. Kidde.





Above is a photograph of an electric radiator and a drawing of the unit with which this radiator is fitted. The radiator comes in various sizes and the heating energy is derived from light socket.—American adiator Co.

(Names and addresses of manufacturers may be obtained on request)

MOTOR HINTS

Conducted by GEORGE A. LUERS

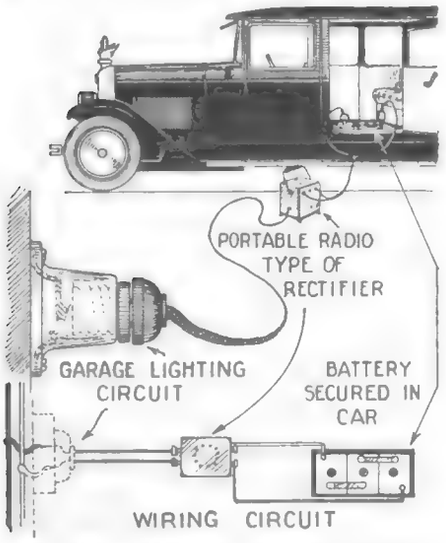
A New Monthly Department Prepared by a Well-Known Automotive Engineer

DO YOU KNOW denatured alcohol is an excellent carbon remover. Try immersing the spark plugs in it.

METHOD OF BATTERY CHARGING WITH PORTABLE RECTIFIER

Storage batteries on the recent models of automobiles, are crowded into very confined spaces. The floor boards make it difficult to remove the battery and in many instances require these to be unbolted and lifted off before the battery clamps can be removed.

A charged battery is essential to car operation, and for that reason the ingenious means which has been adopted by several motorists and shown in the attached sketch, will be found very serviceable and desirable on these new types of cars.



A portable rectifier such as used for recharging radio batteries will be found very handy for keeping the car battery charged up during the winter time.

A portable rectifier, of the electrolytic or bulb type, so frequently used to charge batteries for radio work, is simply removed to the garage for work of battery charging.

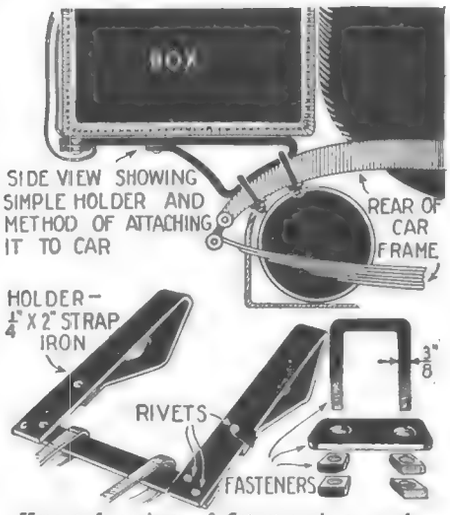
One end is plugged into the garage lighting circuit and the charging leads, with the clip fasteners, are simply gripped on the battery terminals, as shown in the attached sketch.

This means saves battery removal, leaves connections undisturbed and makes it possible to have the storage battery up on charge at all times.

FLAT STRIPS OF IRON MAKE BOX HOLDER FOR THE CAR

Many motorists have occasion for carrying a large box, serving on camping trips, for short outings or to carry foodstuffs. Regardless of the size or shape of the box, a simple and serviceable holder that the car owner can prepare, to support the box on the rear of the car, is that shown in the attached sketch.

To make this holder, three strips of flat iron, ¼ inch by 2 inches wide and four three-eighth-inch "U" bolts, are the materials needed.


BOX
SIDE VIEW SHOWING SIMPLE HOLDER AND METHOD OF ATTACHING IT TO CAR
REAR OF CAR FRAME
HOLDER — 1/4" X 2" STRAP IRON
RIVETS
FASTENERS

How a few pieces of flat strap iron can be arranged to form a box or trunk carrier for the rear of your car.

Bend the ends of two of the strips of iron, that the "U" bolts will fasten them to the spring hangers. Rivet the third piece of iron to form a cross brace and rivet the free ends of the supports, as shown in the sketch.

This complete holder bracket can be made up in an hour or two of spare time. It is quickly attached to the car and as readily removed when its use is not required. The materials will cost less than a dollar or possibly suitable materials may be at hand.

This bracket places the box at the rear of the car and in a safe and convenient position.

Some car owners place boxes on the running board, but the cautious driver will not make this mistake.

A PAINT JOB THAT CAN BE DONE IN THE GARAGE

As a means to prevent rust and decay of the car, frequent painting is required. To do a quick and thorough job of painting, the attached instruction chart is recommended because of the simplicity which attends its use.

Because of the lessened use of the car during February, this is a month during which the car can best be spared for the repaint work.

The procedure in repainting is to follow the charted instructions and the dingy and rusty car is fitted to weather the elements for at least another year. A good dry garage, free from dust and fairly tight is essential to the painting work. There should be no openings for the wind to blow dirt through.

The one job that the motor car owner hates to tackle is that of repainting. Here all of the successive stages to be followed in a repaint job are listed by Mr. Luers, and anyone should be able to obtain very good results with the modern varnishes and paints especially made for this purpose. Try samples of paint on wood first.

The work, as shown in the chart, is arranged in numerical sequence, starting with the first operation at number one and terminating with number twelve.

There will be required for a small car about two quarts of flat ground color and two quarts of clear coach varnish. Additional to paint, two, three-inch bristle brushes, a handful of steel wool, a quantity of curled hair and a long straight edge for putting on the band stripe, are the tools required.

The selection of the colors is the individual asset of the painter and in the selection it is advisable to choose colors that are not too contrasty, but harmonize.

TIGHTENING BALL BEARING ON AN ARMATURE SHAFT

When the ball bearing supporting the armature of a small generator is loose, an imperceptible noise is heard in the generator. This noise on an automobile is practically dimmed by the throbbing of the engine, however if the bearing is allowed to run loose, it is only a matter of time when the generator wears out or as more frequently spoken of "burns out," the wiring being rubbed and shorted.

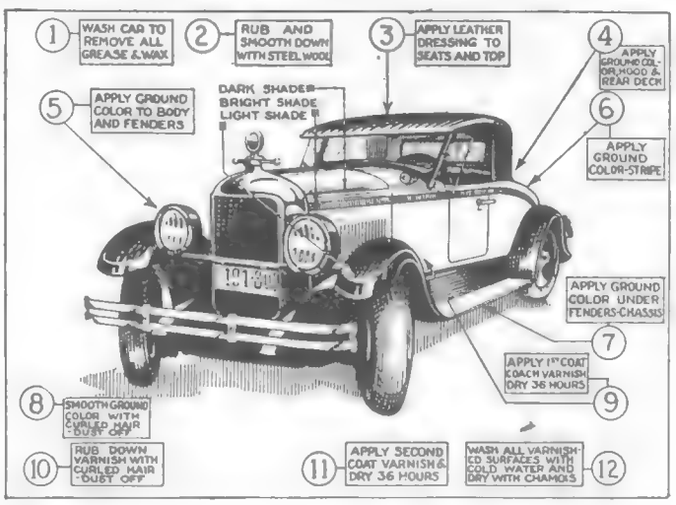
One ingenious method of making the bearing tight, when found loose and hammering, is to use a chisel and with a support under the shaft cut serrations similar to knurling. When the bearing is pushed back on this section of the notched shaft, it will be sufficiently tight to avoid the ruinious knocking. This is a serviceable idea for use during overhaul work on either the generator or the starting motor.

WIRE BRACKET FOR THE HIGH PRESSURE GREASE GUN

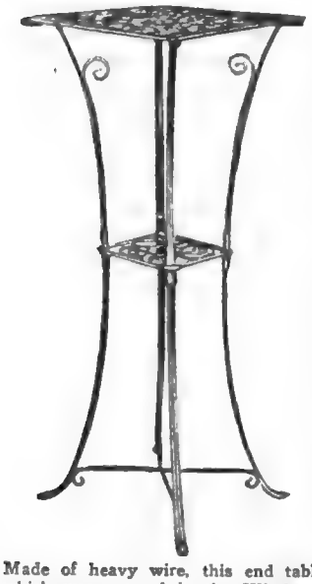
Storing the high pressure grease gun on the automobile, that the barrel will not be dented through contact with other tools, is accomplished in the simple and inexpensive manner shown in the accompanying sketch.

A bracket made from one eighth inch steel

(*Continued on page* 954)


1 WASH CAR TO REMOVE ALL GREASE & WAX
2 RUB AND SMOOTH DOWN WITH STEEL WOOL
3 APPLY LEATHER DRESSING TO SEATS AND TOP
4 APPLY GROUND COLOR HOOD & REAR DECK
5 APPLY GROUND COLOR TO BODY AND FENDERS
DARK SHADE
BRIGHT SHADE
LIGHT SHADE
6 APPLY GROUND COLOR-STRIPE
APPLY GROUND COLOR UNDER FENDERS-CHASSIS
7 APPLY 1ST COAT COACH VARNISH DRY 36 HOURS
8 SMOOTH GROUND COLOR WITH CURLED HAIR - DUST OFF
9
10 RUB DOWN VARNISH WITH CURLED HAIR - DUST OFF
11 APPLY SECOND COAT VARNISH & DRY 36 HOURS
WASH ALL VARNISHED SURFACES WITH COLD WATER AND DRY WITH CHAMOIS
12

WIREKRAFT—$3,000.00 IN PRIZES



Made of heavy wire, this end table which was entered in the Wirekraft Contest presents a sturdy and serviceable device. The illustrations here merely show what some of our readers have been able to accomplish with wire. Officially, no prizes in this contest will be announced until the April issue. Three parallel wires were used to form the legs of the table and the top is artistically decorated with wire spirals, made by the aid of a pair of pliers and soldered into place.

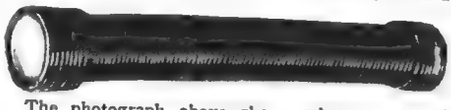
IN the December, 1926, issue of SCIENCE AND INVENTION Magazine a new contest, called Wirekraft, was announced. In this contest the contestants are requested to build things of wire. Any kind of wire, from No. 8 B. & S. gauge to No. 30 B. & S. gauge, is permissible. The prizes will be judged from the standpoint of their wire construction, although it is not essential that only wire be employed. The judges, however, will pass judgment only on those portions of the completed model which have been made of wire.

The first prize in this contest will be $100.00 and an object possessing utilitarian merit will always be selected as the first prize-winning idea. Those contestants, therefore, who are anxious to win the first prize should make sure that their models possess sufficient ingenuity to enter them for this award. Duplicates of articles already on the market will, under no circumstances, be considered.

The second prize of $50.00 will be awarded to the most artistic decorative or construc-

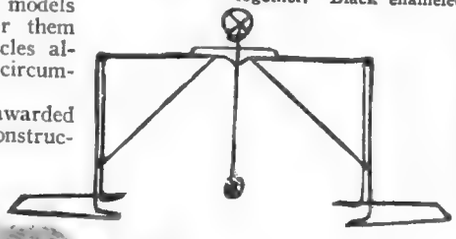
Right: An artistic wire gondola which is also useful.

The wire gondola illustrated in the photograph above may be used either as a lamp if completely covered with silk, or as a bon-bon dish.

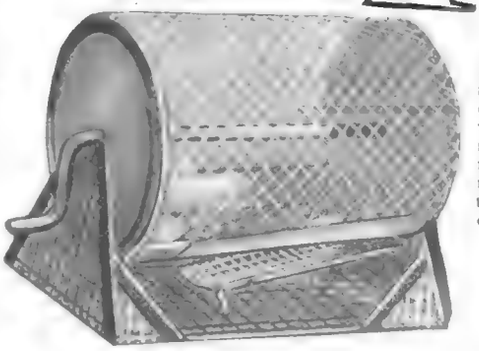


Left: A wire flashlight.

The photograph above shows what one Wirekrafter did in making a flashlight of wire in the form of a long coil soldered together. Black enameled wire was used.



At the left is an ingenious marble game. It will be noted that one marble is hanging from the bottom of a swinging rod. At the top of this rod is a basket into which another marble is put. When the bottom marble is struck, the top one is catapulted from the basket.

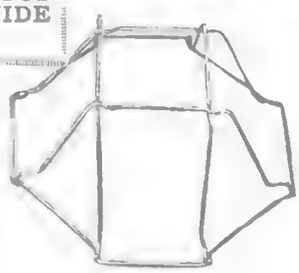


Here we have a Wirekraft corn popper which will also serve as a peanut or chestnut roaster. It may be placed over an open fire.

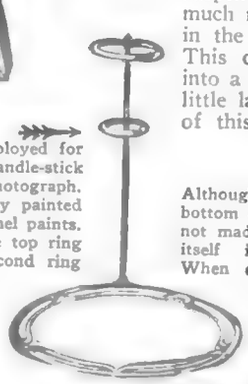
lamp. We next see a flashlight. Then, a game. In the center of the page we find a corn popper, which could also be employed for roasting nuts. This latter device is made of wire screen and thin strips of metal. A very ingenious system is the toaster. This particular device is collapsible and will easily fit into the kitchen drawer or may be suspended on the wall without occupying too much room. A bon-bon dish will be found in the lower left-hand corner of the page. This could also be changed or converted into a fruit dish by making the top of it a little larger. In the upper left-hand corner of this page we find an artistic end table,

(*Continued on page* 942)

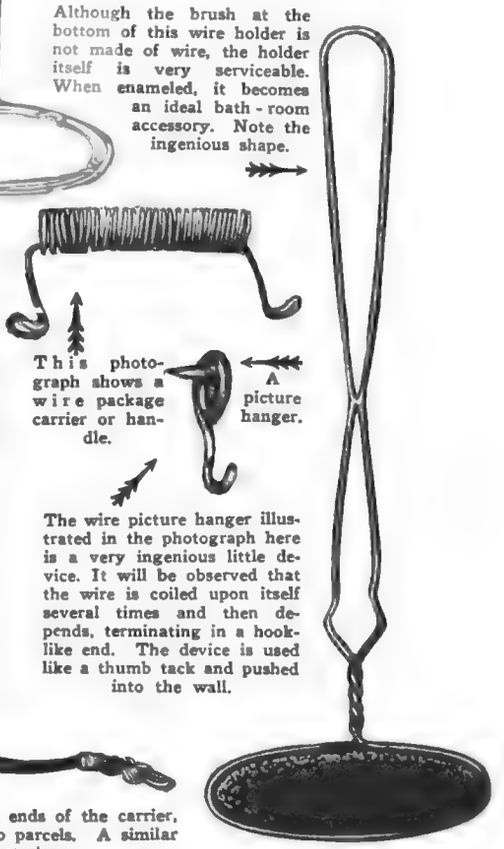
THE FIRST PRIZE WINNING "WIREKRAFT MODELS WILL BE PUBLISHED IN THE APRIL NUMBER. THESE PHOTOS ARE FOR A GUIDE ONLY.



At the right we have a bread toaster made with five pieces of wire and bent as shown. The unusual feature of this bread toaster is that it is collapsible. It thus occupies but very little space when it is to be stored away. Nicks in the wire hold it in place.



How wire may be employed for the construction of a candle-stick is illustrated in this photograph. This model was cleverly painted in two colors with enamel paints. The candle fits into the top ring and rests upon the second ring mounted on the upright stand.

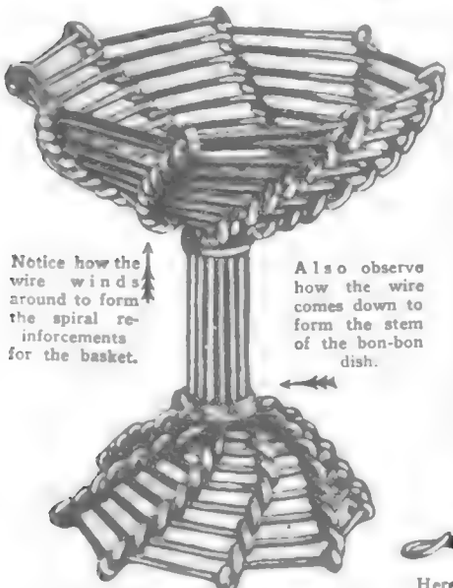


Although the brush at the bottom of this wire holder is not made of wire, the holder itself is very serviceable. When enameled, it becomes an ideal bath-room accessory. Note the ingenious shape.

This photograph shows a wire package carrier or handle.

A picture hanger.

The wire picture hanger illustrated in the photograph here is a very ingenious little device. It will be observed that the wire is coiled upon itself several times and then depends, terminating in a hook-like end. The device is used like a thumb tack and pushed into the wall.



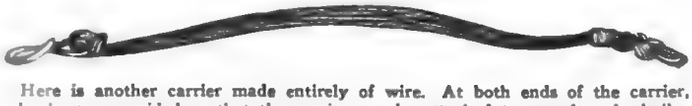
Notice how the wire winds around to form the spiral reinforcements for the basket.

Also observe how the wire comes down to form the stem of the bon-bon dish.

The photograph above illustrates an artistic fruit bowl or bon-bon dish.

tive effect entered during any one month. This may be a replica or a model of some imaginative or existing object, such as a building, a bridge, a ship, a picture-frame, or any other similar device which can be judged under this classification. There is, of course, a possibility that an article will combine both the artistic merit with a utilitarian appeal. In this event, if the article is more utilitarian than artistic, the utility prize will be paid to the winner.

On this page we find a series of photographs of models which have already been built by those seeking honors in this prize contest. The articles may already be classified into two headings, namely, those of artistic value and those which can be practically employed. Among them we find a gondola, which can be used as a bon-bon dish or, if completely covered with silk and fitted with a bulb, may be used as an artistic



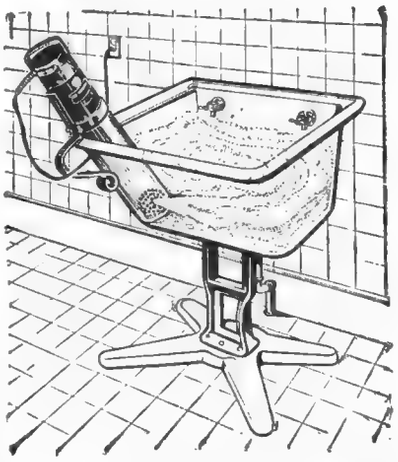
Here is another carrier made entirely of wire. At both ends of the carrier, hooks are provided so that the carrier can be attached to parcels. A similar device can be used for carrying storage batteries.

The Home Scientific

BROOM MOP

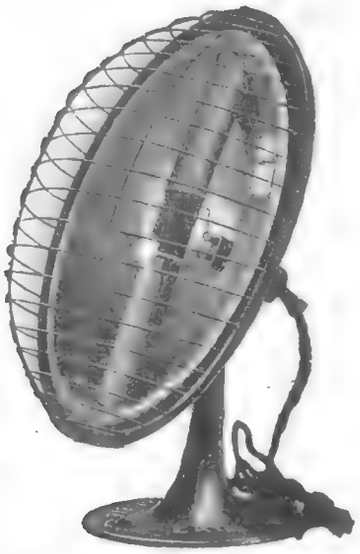
This is a simple invention which transforms an ordinary broom into a mop. The mop slips over the broom.—J. B. Roswick.

CLOTHES WASHER



Here is a portable clothes washer weighing but 21 pounds which fits into any style of wash tub and will wash a tub-full of clothes in from 3 to 15 minutes. The clothes are washed by water alone, a powerful jet of water is driven through the fabrics which swirl about in the tub. The circular group of holes in the illustration are the intake and water issued from an opening at the center.—Freed-Eisemann.

AN UNUSUAL HEATER



This heater combines the three principles in heat generation, radiation, convection and conduction. A tube passes through the heater and the heating coil is mounted in position at the center of the tube. Air is heated by the coil and circulates from the bottom through the tube and out at the top. A large polished reflector helps in radiation.—Dr. E. A. Martin.

COMPLETE KITCHENETTE

Above we see an article of household furniture which, in the illustration at the right, seems to be a console or a reading table. When the device is opened, as the photo at the left shows, we find it completely equipped for a meal. In this position it serves both as a kitchenette and table.—Space Saving Furniture.

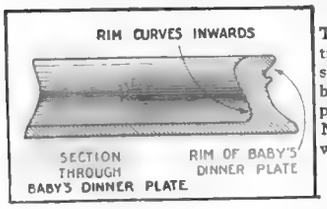
CONVECTION TYPE ELECTRIC HEATER

At the right we have another example of a heater which presents the convection style of heat distribution. A heating unit at the bottom of this heater warms the air and this circulates out of the heater at the top. The cold air enters the device at the bottom.—Wolcott Mfg. Co.

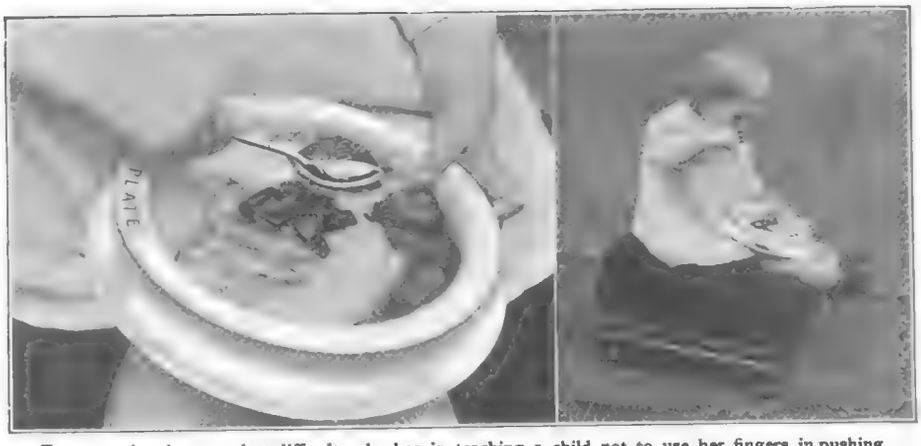
KNIFE SHARPENER

This knife sharpener contains four steel rods arranged to form a V. It is thus possible to get a keen, smooth edge which lasts instead of undercut groove.—Jaywoolf Mfg. Co.

UNDERCUT DINNER PLATE FOR THE BABY



The illustration at the left shows how the baby's dinner plate is made. Note the inward curve of the rim.

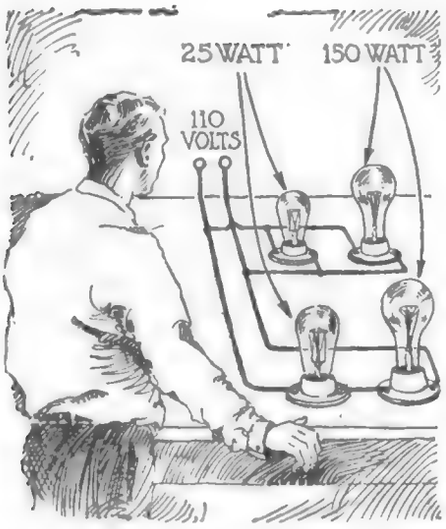


Every mother knows what difficulty she has in teaching a child not to use her fingers in pushing pieces of food on the spoon or fork before transmitting the food to the mouth. This plate permits the child to master picking up food without spilling contents.—C. A. Oldroyd.

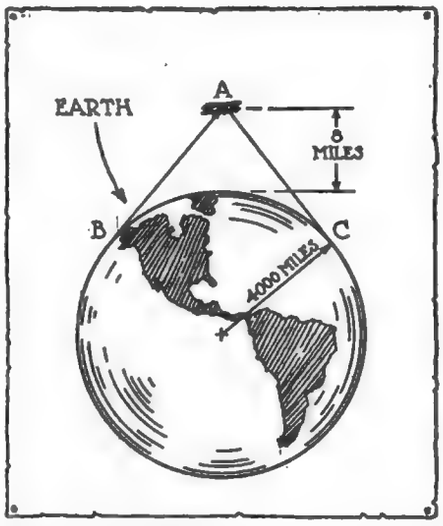
(Names and addresses of the manufacturers may be obtained upon request)

Scientific Problems and Puzzles

By ERNEST K. CHAPIN



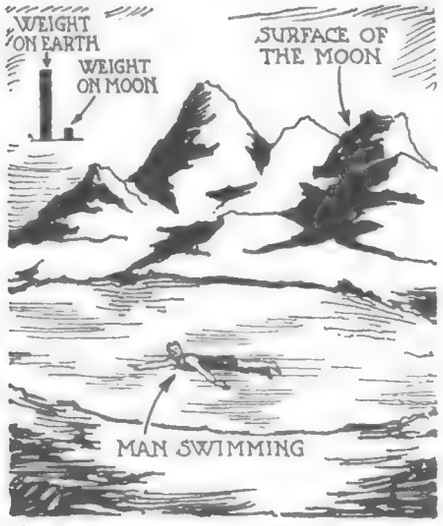
A 25-watt lamp and a 150-watt lamp are connected first in parallel and then in series with a 110-volt circuit. Which lamp will be the brighter in each instance?



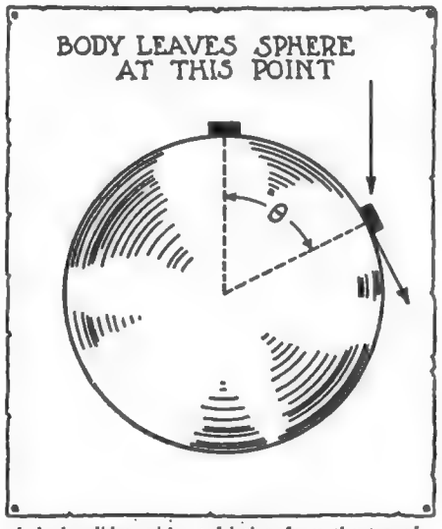
The world's altitude record is 8 miles. Assuming the radius of the earth to be 4,000 miles and atmospheric conditions perfect, over what arc (BC) could the aviator see?

Can the girl in this drawing see a full length image of herself by either approaching or receding from the mirror?

It is said that if you strike together a moving and a stationary egg, a moving egg is more apt to be broken. Is there any scientific reason for this?

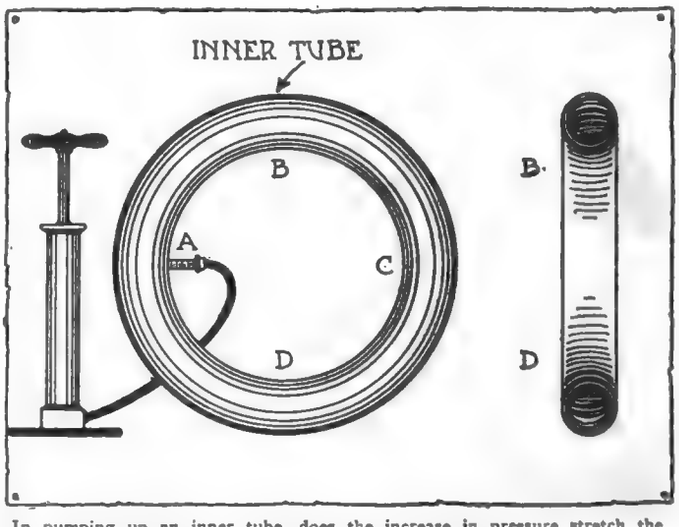


On the moon a man would weigh about 1/6th as much as he weighs on the earth. If there were any water on the moon would swimming be any easier on that account?



A body slides without friction from the top of a smooth sphere. How does the angle through which the body slides depend upon the size of the ball?

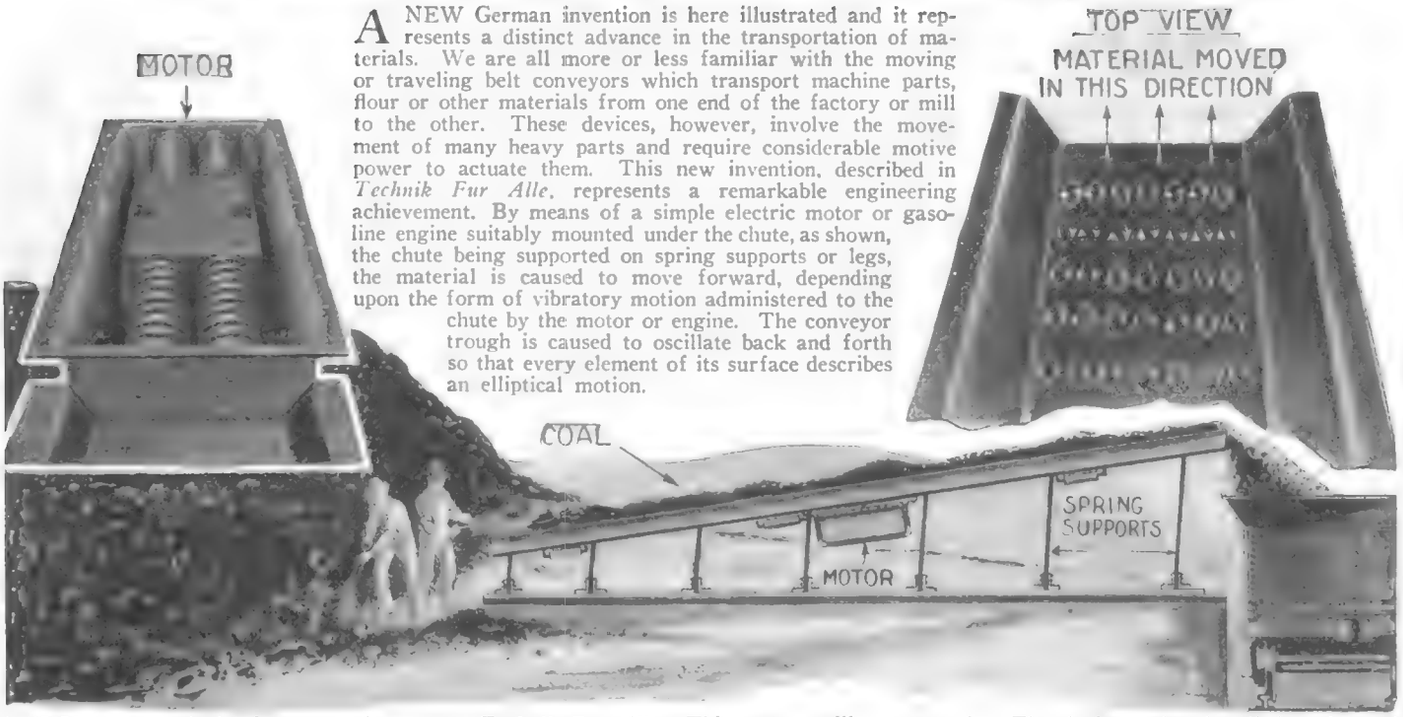
It is sometimes difficult to tell by looking at a pair of spectacles whether the lenses are concave (thinner at center than at edge) or convex (thicker at center than at edge). What is an easy way of determining to which class the lenses belong? Method should apply to other simple lenses.



In pumping up an inner tube, does the increase in pressure stretch the inner circumference, compress it, or leave it unaltered? That is, in the figure, would the circumference ABCD be increased, decreased or would it remain the same as before application of pressure?

(*See Answers on page* 948)

Vibration Moves Materials Along Chute



A NEW German invention is here illustrated and it represents a distinct advance in the transportation of materials. We are all more or less familiar with the moving or traveling belt conveyors which transport machine parts, flour or other materials from one end of the factory or mill to the other. These devices, however, involve the movement of many heavy parts and require considerable motive power to actuate them. This new invention, described in *Technik Fur Alle*, represents a remarkable engineering achievement. By means of a simple electric motor or gasoline engine suitably mounted under the chute, as shown, the chute being supported on spring supports or legs, the material is caused to move forward, depending upon the form of vibratory motion administered to the chute by the motor or engine. The conveyor trough is caused to oscillate back and forth so that every element of its surface describes an elliptical motion.

THIS new method of transporting materials by simply setting up oscillatory vibrations in a steel chute is a clever product of the engineering mind. The picture shows a movable trough capable of transporting about eight hundred cubic feet of material per hour, with an expenditure of but one-half horse-power hour, according to *Technik Fur Alle*. This system will transport any material, fine or coarse, it does not mix up, produces no dust and doesn't react. Material can be transported up a 15 per cent incline, and the only attention required is the necessary lubrication every two months. A heavy foundation is not required, and the mounting is extremely simple. The device makes but little noise and it is easily made thoroughly weatherproof. The device brings to mind the little known principle of the whip-motor, which produces a rotary motion of a shaft due to vibratory action produced on a drum secured thereto, as a result of the whipping action of a magnet actuated flexible belt on the drum.

The Astrology Humbug

By JOSEPH H. KRAUS

Further Letters From Our Readers and Our Answers

FLORENCE B'S HOROSCOPE!

Editor SCIENCE AND INVENTION:

Regarding your article on Astrology in your October issue, I am not desirous of entering your competition for I know very little of Astrological prophesying but just as an example of showing how the planets denote the *tendencies* (please note the underlining) in a person's life, may I give a few of my deductions from the map attached to your article.

First of all, if this is the horoscope of "Florence B" I am utterly at a loss to see any signs of an early death, but if it is another's map, here are a few points.

Mars rising, or rather in the twelfth house, and square to Uranus in the tenth would show trouble from a spasmodic complaint such as gout (or in a worse case—paralysis) (the 12th ruling the feet and the tenth the ankles and knees) causing loss to the position in life (10th house) and toward the latter end of life (the 12th). The same position would also indicate many secret enemies. Mercury rising in the 1st house would give commercial aptitude and a brilliant, fast-thinking mind especially being trine to Uranus in the tenth. Saturn in Libra in the 5th, would indicate few children and delay or bereavement in love affairs before marriage. Venus being square to the moon would show loss of wife or as the moon is in aspect to more than one planet, *more* than *one* marriage. Being in good aspect to the sun, the moon shows that money affairs will be good and a watery sign being on the 2nd house (the house of money and belongings)—fortune will most likely be made through lands over the seas. Neptune in the 9th and in good aspect to the first house shows long journeys connected with some sort of marital pursuit or some ruling capacity—more like a governor in fact. By the way, Saturn in Libra in the fifth in good aspect to Jupiter in the second would seem to indicate that there was financial improvement through marriage and speculation (the fifth house). And lastly, the moon in the twelfth house Venus in the sign of Leo shows that death will finally be brought about, not by hereditary complaints (the Sun constitution being strong) but by high living and a gradual breaking down of the strength caused through same. So to be frank—a case of wine, women and song helped by the before mentioned secret enemies.

As I said before, I have no wish to enter your competition as I am not a competent and fully qualified astrologer—far from it. As a matter of fact, I destroyed all my books connected with it, owing to the fact that all evil things seem to come on time, whereas the good points have to be fought for and held on to. I do believe that our tendencies are pointed out, but we are given free-will to either overcome them—or else just glide along in a fatalistic way. Remember the Bible saying "God put signs and seals in the heavens and in the hands of men that all may read."

If you have any acquaintance with the person whose horoscope is delineated above, compare his or her life with what I have written. I have written it as if about a man, but change the part of many marriages—the sun (The sign of the husband in a woman's map) not being afflicted and you can give it as a woman's horoscope.

Please understand that this is only a private communication to you and that I am not trying to start a controversy. I haven't bothered with it for some little time but thought a word or two on the subject would neither help nor hinder.

DAVID R. LAWRENCE,
Ontario, Canada.

(In view of the fact that the writer was very intimately acquainted with "Florence B." and also that "Florence B." was a girl, we will analyse the statements that you have made as a result of your findings. Your statement to the effect that Mars in the twelfth house and square to Uranus which showed trouble from a spasmodic condition, such as gout or paralysis is incorrect. The individual being still in her prime when she died, would scarcely indicate gout and of course she was not paralyzed. To the writer's knowledge who, as stated before, knew the said party intimately for many years, there was never an enemy in the life of this very amiable young lady. Your statement to the effect that she had a commercial aptitude and a brilliant fast thinking mind is correct.

Your statement to the effect that the individual would have few children or bereavement in love affairs before marriage, is likewise incorrect, the subject having had no children and her only love affair was ended by her death. The subject did not lose her husband and having never been married, the statement that she would have more than one marriage, is likewise not founded.

Contrary to your statement that money affairs would be good, money affairs were very difficult until the latter years of her life. Having lost her father at a very early age, it was necessary for her

(Continued on page 959)

$6,000.00
For Proofs of Astrology

SCIENCE AND INVENTION Magazine holds that there is nothing scientific in Astrology, that Astrology is not a science and that statements made by astrologers unless very general cannot be entertained seriously.

Accordingly, this publication has decided to award an Astrology Prize of $6,000 for the following:

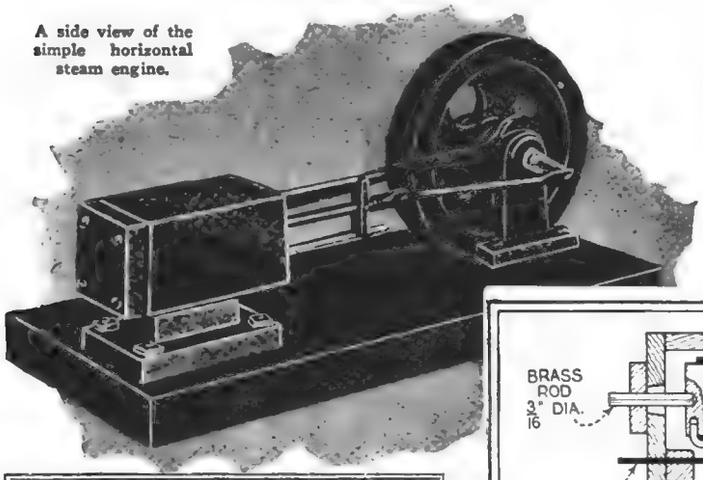
$5,000 will be paid to the astrologer or forecaster who will foretell three major events of such a nature that he will have no control over the outcome of the same. He must describe in advance each event in detail, giving the location and result or the casualties if the event is an accident.

$1,000 will be paid to the astrologer or forecaster who will produce three accurate, detailed and perfect horoscopes, free of contradictions on the lives of three people whose initials will be given him when he requests the same and the birth dates and place of birth will also be supplied by this office.

This contest closes October 1st, 1927, and all entries must reach us by that time. In event of a tie, prizes of an identical nature will be given those so tying.

Address all entries to Editor, Astrology, care of SCIENCE AND INVENTION Magazine, 53 Park Place, New York, N. Y.

MODEL DEPARTMENT

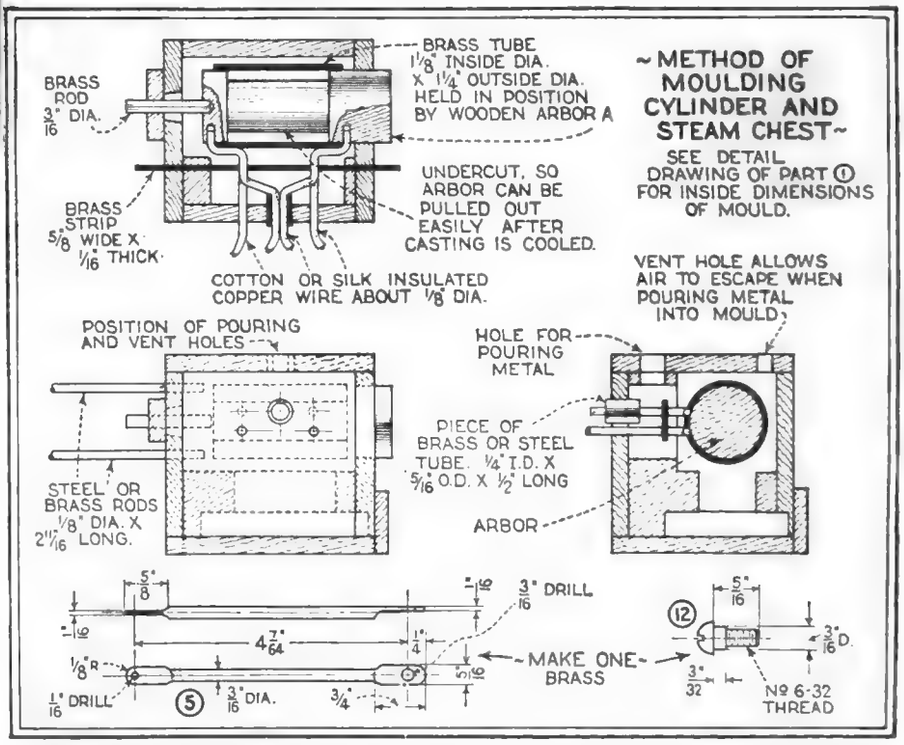


A side view of the simple horizontal steam engine.

Simple Steam Engine

A Horizontal Steam Engine Which Will Work When Its Builder Blows Into the Steam Chest. It Can Be Built of Odds and Ends with Such Tools as are Generally Found in Every Home.

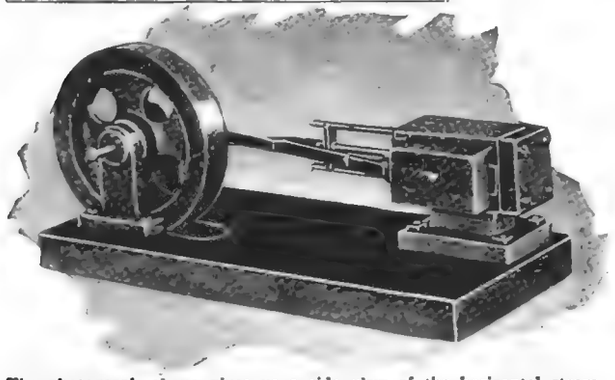
THIS model was entered in the Cup Contest but did not win an award. Because of its ingenuity and its simple construction, this magazine has decided to show its readers how to build the engine. The original model was made by Bernard T. Jaeger, of Richmond Hill, L. I. The constructional drawings are found on these pages.

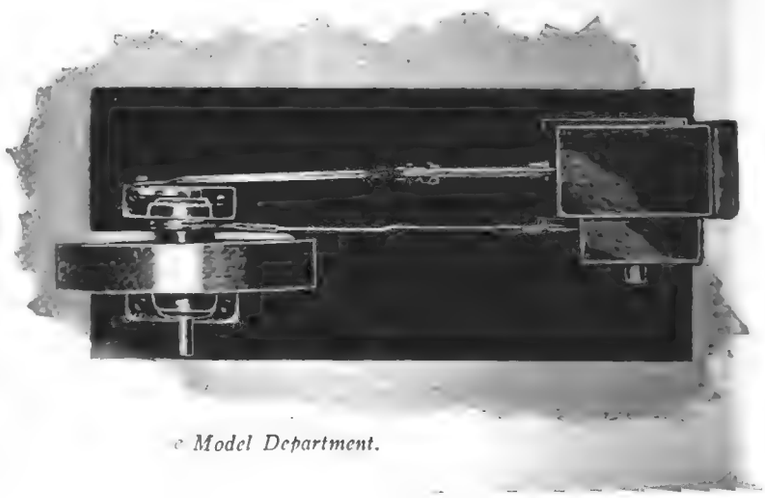

BRASS TUBE 1⅛" INSIDE DIA. X 1¼" OUTSIDE DIA. HELD IN POSITION BY WOODEN ARBOR A
BRASS ROD 3/16" DIA.
BRASS STRIP 5/8" WIDE X 1/16" THICK
UNDERCUT, SO ARBOR CAN BE PULLED OUT EASILY AFTER CASTING IS COOLED.
COTTON OR SILK INSULATED COPPER WIRE ABOUT 1/8" DIA.
~METHOD OF MOULDING CYLINDER AND STEAM CHEST~
SEE DETAIL DRAWING OF PART ① FOR INSIDE DIMENSIONS OF MOULD.
VENT HOLE ALLOWS AIR TO ESCAPE WHEN POURING METAL INTO MOULD
POSITION OF POURING AND VENT HOLES
HOLE FOR POURING METAL
PIECE OF BRASS OR STEEL TUBE. ¼" I.D. X 5/16" O.D. X ½" LONG
STEEL OR BRASS RODS 1/8" DIA. X 2 1/16" LONG.
ARBOR
5/8"
4 7/64"
1/8" R
1/16" DRILL
⑤
3/16" DIA.
3/4"
1/4"
3/16" DRILL
MAKE ONE BRASS
⑫
5/16"
3/16" D.
3/32"
№ 6-32 THREAD

The above illustration shows the method of moulding the cylinder and steam chest. This model was made of odds and ends of material, such as found in almost any home work shop. A mould was made of discarded cigar boxes and type metal was used for the steam chest. The cylinder itself is a piece of brass tubing inserted in the mould. The ends of the tube were closed with a wooden plug. The cores for the inlet and outlet ports were made of insulated wire (telephone or bell) double cotton covered, and of about ⅛ inch outside diameter. These wires were pulled out when the casting had cooled. A flywheel from an old machine can be employed. The tools required in its construction were drills, file, hammer, screw driver, a small wrench, a set of taps, a breast drill, a soldering iron, and a saw, but of course a lathe will come in handy.

Rules for Model Contest

1. A handsome trophy cup engraved with your name, will be awarded as the prize for the best model submitted during the month. The decision of the judges will be final and will be based upon, A—novelty of construction; B—workmanship; C—operating efficiency of the model as related to the efficiency of the device which the model simulates, and D—the care exercised in design and in submitting to us sketches and other details covering the model.
2. Models of all kinds may be entered. They may be working models or not, according to the subject that is being handled.
3. Models may be made of any available material, preferably something that is cheap and easily obtainable. Models made of matches should not be submitted to this department but should go to our Matchcraft Contest Editor.
4. Models must be submitted in all cases. Good photographs are also highly desirable and where the maker does not desire the model to be taken apart, legible drawings with all dimensions covering parts that are not accessible must be submitted.
5. Models should be securely crated and protected against damage in shipment and sent to us by parcel post, express or freight, prepaid. Models will be returned when requested.
6. Models for entry in any particular contest must reach this office on or before the 25th of the third month preceding date of publication. For instance, models for the March contest must reach us on or before the 25th of December.
7. Address all entries to Editor Model Department, c/o Science and Invention Magazine, 53 Park Place, New York City.

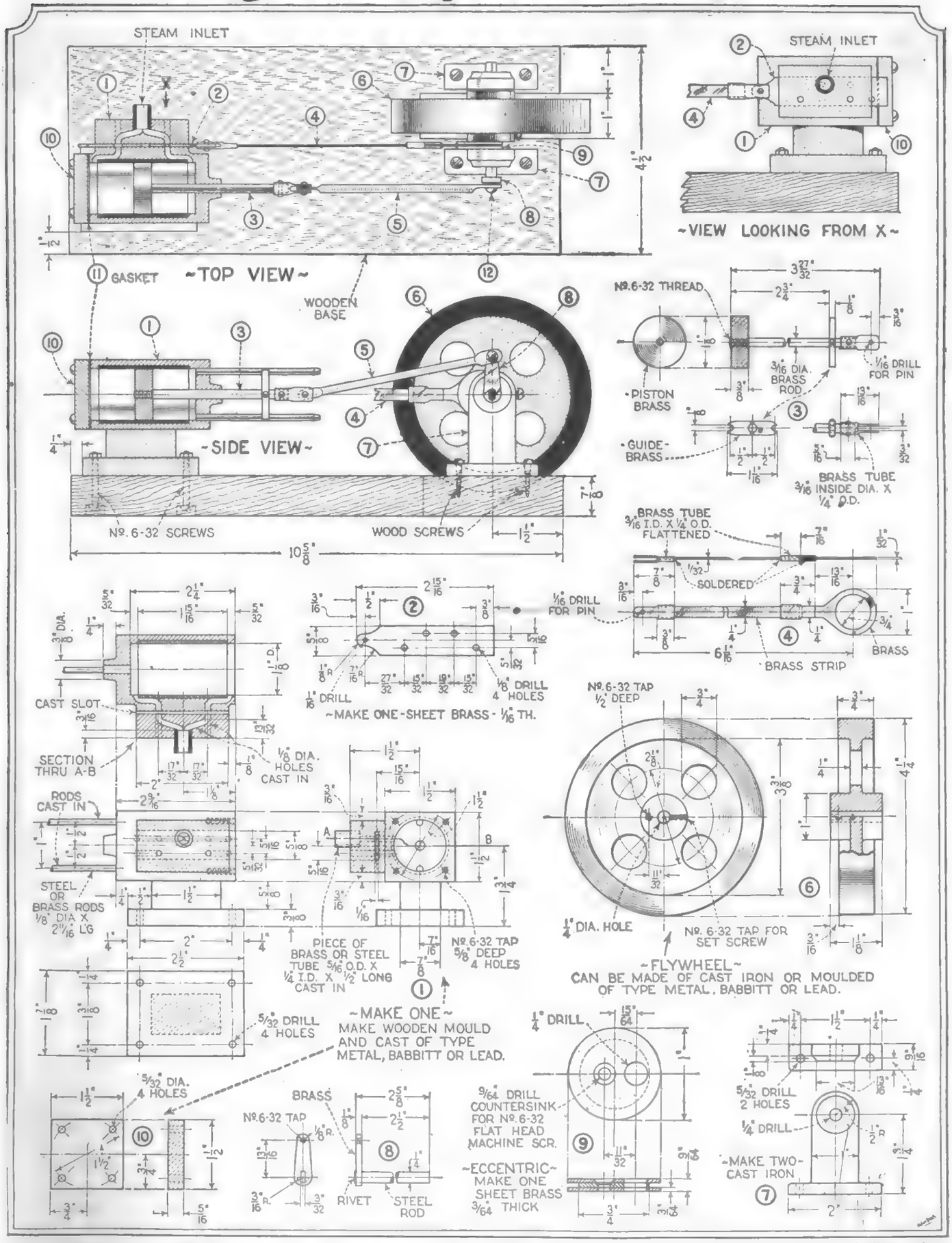




The photograph above gives us a side view of the horizontal steam engine when looking at it from the steam chest side. This engine if correctly built may be made to spin at a lively rate of speed when its builder blows into the inlet. The photo at the right gives us a top view of the completed model.

Blue-prints of Models are *e Model Department.*

Design of Simple Steam Engine

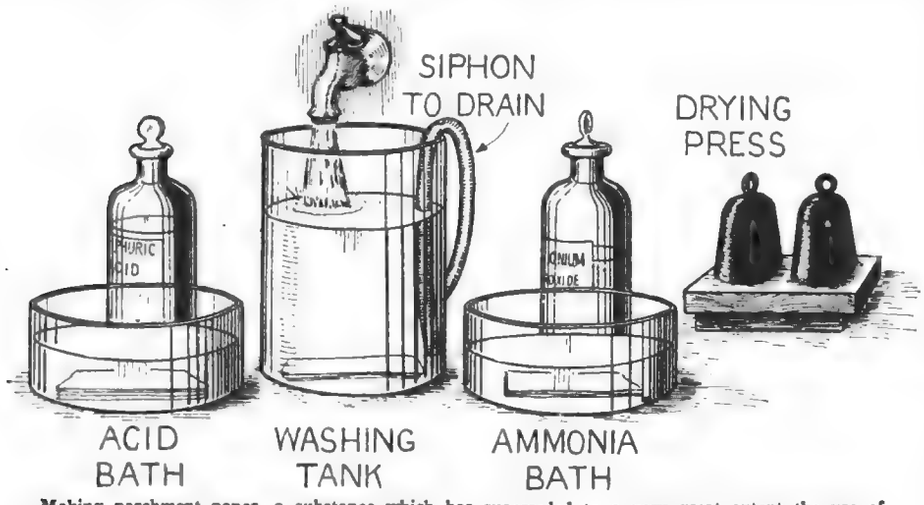


The drawings above explain in detail the assembly and the construction of the simple steam engine. We wish to call the attention of our readers to the SCIENCE AND INVENTION Magazine Trophy Contest announced on the previous page and wish to advise them that the contest conditions are easily met, that the models are returned to the builders and that contestants stand a good chance of winning the handsome trophy which is awarded monthly. Those interested in building models will find it profitable to study the article on "Blueprint Reading" in January issue.

Chemical Experiments With Paper

By EARLE R. CALEY, B.Sc., M.Sc.

PAPER is a substance that serves the experimenter in countless ways. It is an indispensable substance, in the laboratory, just as it is for modern civilization. The nature and structure of paper, especially unsized paper, is such that it can be altered and changed in many ways and made to serve many purposes. Its surface can be colored and coated with many substances. It can be saturated with other substances readily. Common examples are carbon papers, paraffined papers and insulating papers. It is the purpose in the following article to detail in the form of short and simple experiments some rather unusual and uncommon ways in which ordinary paper can be changed and made to serve uncommon purposes. In all these experiments only a few ordinary chemicals and simple apparatus are required.



Making parchment paper, a substance which has superseded to a very great extent the use of sheepskin, formerly so frequent. The college student now no longer gets his "sheepskin", but will get his "parchment paper."

Experiment 1—Laboratory manufacture of parchment paper.

Very little, if any, true parchment is made or used at the present time. Most so-called parchment that is in use now, is simply treated paper that is just as good for nearly all purposes as is real parchment. This modern parchment is made by treating paper with sulphuric acid. A peculiar thing about this, is that the acid has to be of just the right concentration. The most concentrated laboratory reagent will immediately cause ordinary paper to turn black and char. This may be shown by dropping some of the acid on a piece of paper. On the other hand dilute sulphuric acid causes no marked alteration in paper. The proper details for successfully making parchment paper in the laboratory are given in the following sentences. The first step is the preparation of the acid. One hundred cubic centimeters of water are placed in a beaker and to this added, *very slowly and cautiously* at first, two hundred and fifty cubic centimeters of pure concentrated sulphuric acid. The addition of the acid must be done very slowly and with constant stirring. This solution is then allowed to cool down to room temperature, and is then poured into a flat, shallow dish or plate. A sheet of unsized paper (ordinary white blotting paper will do) is then placed in this solution for ten seconds and immediately transferred to a pan of water that has water running into it from a tap. The paper is allowed to remain in this washing bath for one-half hour. It is then immersed in a solution made by adding five cubic centimeters of ammonia to two hundred cubic centimeters of water. It is again placed in the running water for a ten minute period. The purpose of all this washing is to remove the slightest traces of the sulphuric acid. The paper is now dried. If simply hung up to dry in the usual manner the parchment paper will develop many wrinkles that are almost impossible to remove. The best way to dry it is to place it between two pieces of blotting paper of the same size as the parchment and then place weights on the papers until the parchment is entirely dry. When properly prepared this artificial parchment is translucent, tough, and changed very markedly from the weak, unsized paper from which it was prepared.

Experiment II—Prepared paper for printing without ink.

Instead of using ink for printing characters on paper, paper can be prepared in such a way that the ink-making ingredients are in the paper in a dried form. Then by simply moistening a rubber stamp with water the printing can be done upon this paper. In a similar manner a pen moistened with water will write upon paper so prepared. The best kind of paper to use in this experiment is slightly-sized paper having a rough surface and a porous structure. Two different chemicals are then rubbed into the paper in the form of very fine powders. The first chemical to be applied is copper sulphate. The blue crystals are thoroughly ground in a mortar and sifted through fine cloth (bolting cloth is excellent) to obtain a very fine powder. This powder is then evenly rubbed into the paper with a cloth pad. In a similar way powdered potassium ferrocyanide is rubbed into the paper. It is essential that the paper and the chemicals be entirely dry. In order to print upon this paper it is only necessary to moisten a rubber stamp with water as shown in the illustration and apply it the usual way. The characters appear in brown.

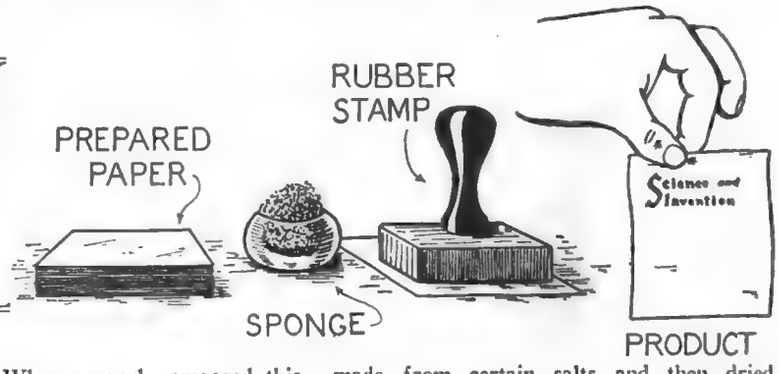
Experiment III—Blotting paper that removes ink spots.

A blotting paper that acts as a ink spot remover for ordinary iron tannate ink, can be easily made in the laboratory. A solution of oxalic acid in alcohol is made by dissolving twenty grams of the crystallized acid in one hundred cubic centimeters of denatured alcohol. A piece of ordinary blotting paper is soaked in this solution for a period of ten minutes and hung up to dry. This paper will completely remove fresh ink blots and dry ones also if they are moistened first before using the paper. Needless to say this paper will not work with carbon black drawing inks and similar products.

Experiment IV—Making fireproof paper.

One of the well-known qualities of ordinary paper is that it is readily combustible. This is an objectionable feature about paper that is to be used in places where it is liable to come in contact with flames or to become overheated. Paper can be treated in such a way that its liability to easily catch fire is greatly reduced. It is soaked in a solution made from certain salts and then dried.

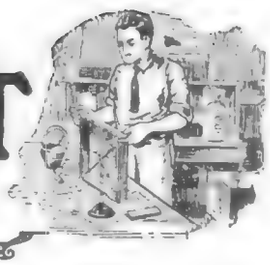
An interesting experiment in preparing paper in which chemical impressions are produced by the use of a rubber stamp and special paper properly treated for the work.



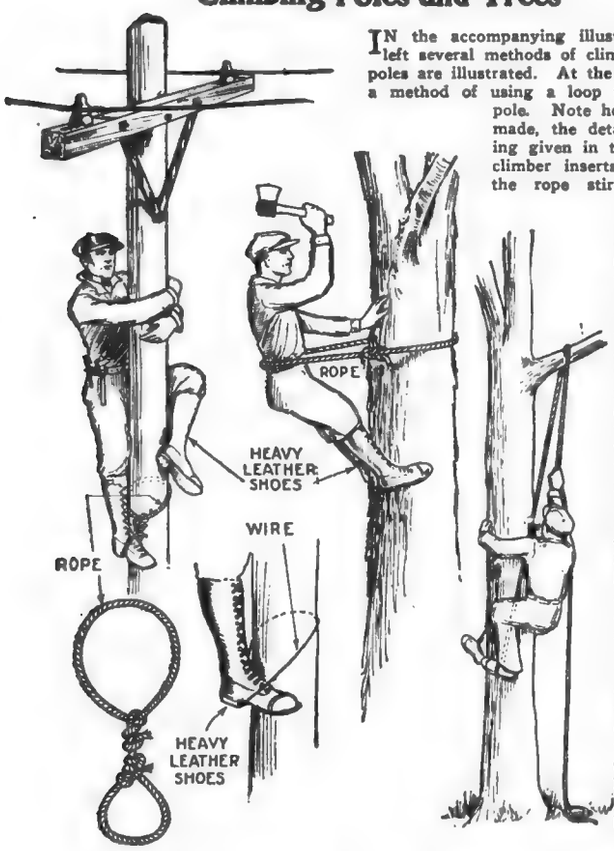
The solution is made in the following manner:

Borax	5 grams
Boracic acid	9 grams
Ammonium sulphate	25 grams
Water	250 c.c.

HOW TO MAKE IT



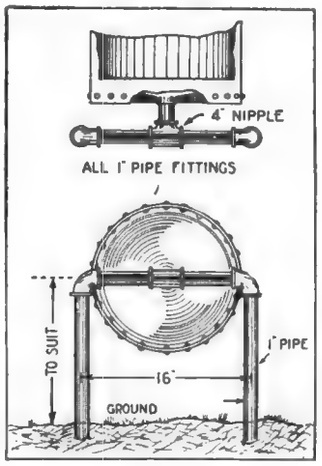
Climbing Poles and Trees



IN the accompanying illustrations at the left several methods of climbing trees and poles are illustrated. At the extreme left is a method of using a loop to encircle the pole. Note how this loop is made, the details thereof being given in the insert. The climber inserts his foot into the rope stirrup, slides the rope upward with his foot and then permits his weight to cause the rope to grip the pole. A wire may be employed for the same purpose, and preferably iron hay wire is used in this method. If the individual provides himself with a rope to encircle his body, he can brace his feet against a rough tree and use the method illustrated for cutting the limbs off a tree. In the last method the individual pulls on the rope, raises his foot and then lifts his body to the newer position.

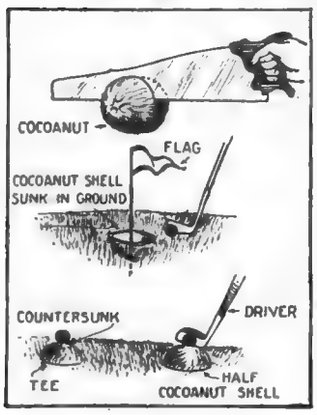
Boiler Flower Tank

THERE is, of course, nothing absolutely new in using the old hot-water boiler for a flower bed. Generally half of the boiler is cut off with a cold chisel and by the aid of a hack-saw. Holes are then drilled through the other half to permit water to drain freely through the tank. The new and novel feature of this particular system is its method of support. This is both neat, rigid and practical. It is made entirely of old pipes and pipe fittings.



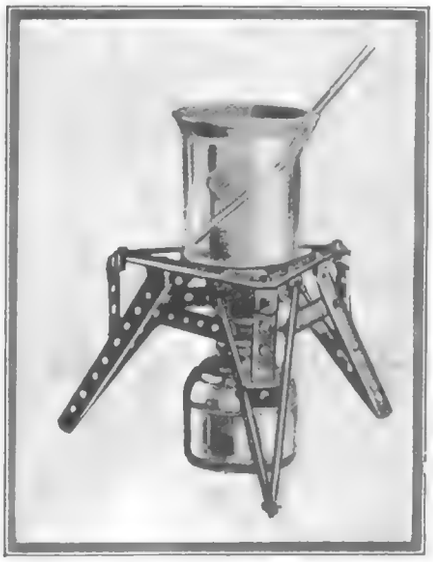
Many times supports made for such a bed are large and clumsy and they consequently destroy the tasty and artistic appearance of the container. The rugged simplicity gives the tank a chance to display its charges to advantage. Its durability and neatness cannot be questioned. In the diagram immediately above full descriptions are given—*Frank Bentley.*

Golf Holes and Tees



Very neat and simple holes for the back-yard putting green can be made by sawing a cocoanut in half. The halves are sunk into the ground. A small hole at the bottom will permit rain to pass through the shell. Turned upside down they make good tees.—Wilson G. Walters, Rep. No. 6385.

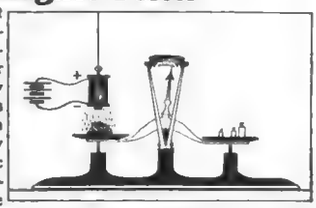
Tripod From Toys



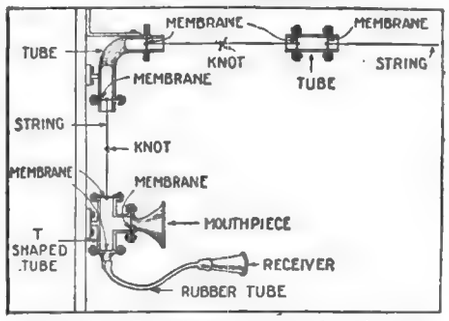
The above photograph shows an ingenious method of constructing a tripod for any chemical experiments from parts easily obtained in toy constructional outfits available on the market today. This type of a tripod is both sturdy and rigid. It can be made in different sizes to suit the height of either a Bunsen burner or an alcohol flame by simply changing the size of the metal strips used in its construction. —Dr. E. Bade.

Magnet Tester

Many times it becomes necessary to determine whether or not a body is or contains material which is attracted by a magnetic force. Frequently these materials contain very slight quantities of magnetic substances. Place substances on a scale, balance them and apply the magnet as shown.—Kelita J. Shugart, Rep. No. 28652.



String Telephone

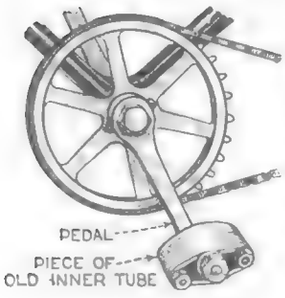


The old string telephone comes into its own again with a new innovation for carrying the telephone around corners. Two membranes are provided at either end of a pi... the work. A straight pipe carrying the line out of the

WRINKLES
RECIPES & FORMULAS

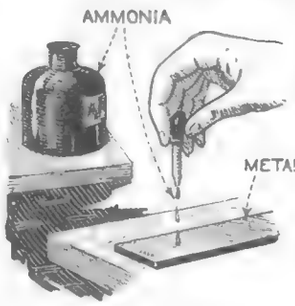
Edited by S. Gernsback

PEDAL ANTI-SLIP



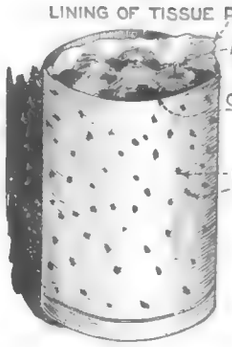
In order to prevent the foot from slipping off a bicycle pedal when the rubber on the pedal has become worn, a piece of inner tube can be slipped over the pedal. — F. Bishop, Rep. No. 25545.

COPPER TEST



A few drops of ammonia placed on a piece of metal, which may be either copper or an alloy of copper, will develop a blue stain if the substance is pure copper.— Sidney Berlowitz, Rep. No. 28219.

DEODORIZER



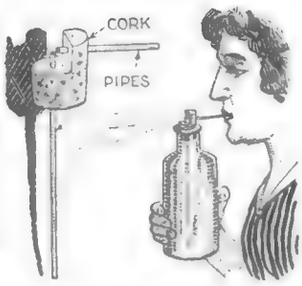
Numerous holes are punched in sides of a baking powder can and the can is lined with tissue paper and then filled with equal parts of asbestos wool and powdered charcoal. This is for icebox use. — Alden Henry Johnson.

BRUSH CLEANER

Paint brushes, on which the paint has hardened, can be cleaned by placing them in a pan full of boiling water and adding a liberal amount of any of the standard cleaners found in the kitchen.—Lawrence K. White, Rep. No. 22014

ATOMIZER

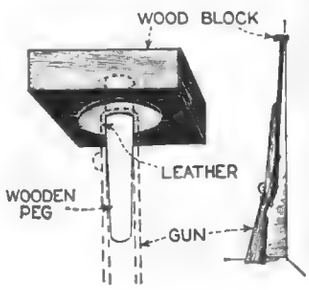
A simple atomizer for spraying perfumes or other substances may be made from a cork and two pipes mounted at right angles to each other and arranged as in the illustration.



MYSTERY BOAT

A boat cut out of camphor and placed in distilled water will move around very rapidly. It will stop its movement if a wand dipped in sulphuric acid touches the water. — Lawrence Holdridge.

GUN HOLDER



This gun holder prevents the sights from leaning against the wall, keeps the dust out of the barrel and removes the danger of the gun falling. It consists of a small block of wood, a wooden peg and a piece of leather. — William Hitechew.

STAIN REMOVER

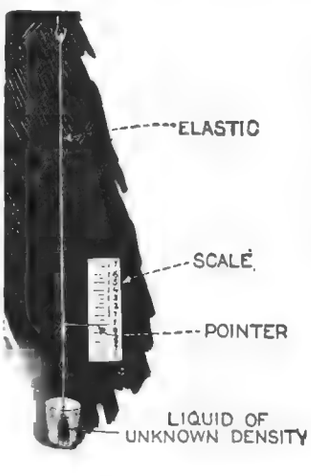
Iodine stains and grease spots may be removed from linen if the stained cloth is immersed in boiling lime water and then rinsed. Grease spots are then washed with soap.— National Lime Association.

"SING" PREVENTER

Frequently telephone wires cause a ringing or singing sound in the telephone, particularly if those wires are fastened to wooden buildings. A heavy cloth or sack wrapped around the wire will prevent this. — Audie Robinson.

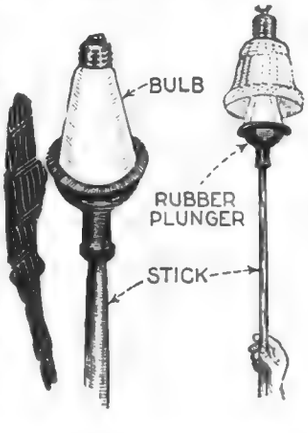
SPECIFIC-GRAVITY METER

A weight suspended from an elastic band and immersed in distilled water to get the zero marking of the pointer and then regraduated with liquids of other known densities will make an accurate [illegible] gra[illegible] —[illegible]



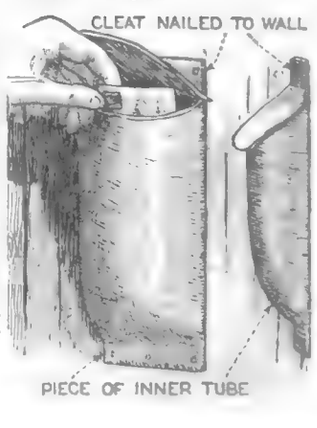
LIGHT REPLACER

The rubber force cup or plunger used for cleaning stopped drains can be mounted on the end of a long stick and can be employed for replacing burnt out incandescent bulbs in fixtures beyond the average reach. The proper size plunger should be secured. — Briggs, Rep. No. 19210.



MAIL BOX

An ideal box for mail or newspapers can be made of a piece of inner tube nailed to the wall in the manner shown in this illustration. Note that the flap protects the contents of the box. Being made of rubber, it is impervious to water.— A. Moyer.



SCIENCE AND INVENTION desires to hear from its readers. It solicits comments of general scientific interest, and will appreciate opinions on science subjects. The arguments pro and con will be aired on this page. This magazine also relishes criticisms, and will present them in both palatable and unpalatable forms. So if you have anything to say, this is the place to say it. Please limit your letters to 500 words and address your letters to Editor—The Readers Forum, c/o Science and Invention Magazine, 53 Park Place, New York City.

$1,000.00 FOR PROOF OF NEWTON'S FORMULA

The writer of this letter offers $1,000.00 for proof of Newton's formula, through actual pendulum clock tests, in any deep mine in the United States.

The writer is the author of a new theory of the Universe, which he calls "The Theory of Absolutivity." This theory denies the "the assumed basis of fact" on which Newton built his theory.

For, if Newton built his theory to account for certain "supposed" facts, and I can prove through actual experiment, that just the reverse of these facts exists, then Newton's theory can have no right to a place in the scientific world.

Newton's theory affirms that the force of gravity diminishes in direct proportion to the distance from the earth's center below it, as we descend into a deep mine, the zero point being reached at a depth of approximately 4,000 miles. It affirms, that the seconds pendulum, swinging 86,400 beats in one sidereal day at the mouth of the mine, will lose one beat each 24 hours for each 86,400th of the distance covered, coming to complete rest at the center of gravity below.

"If" the center of gravity is indeed below, and if gravity is a "pull" from below, then his reasoning would be inevitable.

If the pendulum loses as we descend into a deep mine, then Mr. Newton's theory is a marvel of sound logic; but if it gains one beat for each 480 feet of distance we descend, (as the writer claims it will) then Mr. Newton was simply trying to explain something that had existence only in his fertile imagination.

Data given me from Washington, D. C., assert that if, at the bottom of a mine the pendulum loses 5 beats in 24 hours, as compared to a similar clock at the mine's mouth, then the depth of the mine will be approximately 2,440 feet. They could not, however, give me record of any experiment to prove this, but asserted that it was based on "recognized formula."

The writer contends that for every 480 feet of depth negotiated, the pendulum will, in 24 hours, *increase* its beat or gain one beat, over a similar clock placed at the mouth of the mine.

The writer further claims that this result will be entirely independent of the character of the strata penetrated, and will be true in any mine, any time, anywhere in the world.

The issue then between "Absolutivity" and Newton's theory is clear cut.

If Newton's theory is correct, then in a mine, say 4800 feet deep the clock at the bottom of the mine would lose 10 beats. If "Absolutivity" is true it will gain 10 beats in each 24 hours, over a clock placed at the mouth of the mine.

Space will not permit me to give the reasons for this, but would take great pleasure in doing so later, if allowed the space.

My offer is this:

I will agree to accompany any man in America, at any time, to any mine in America over 4,000 feet in depth, and if he can show by actual experiment that the clock loses so much as one beat at the bottom of the mine in 24 hours, I will pay $1,000.00 for the information.

The $1,000.00 will be deposited by the writer ten days before the date agreed on for the experiment, in any Bank or Trust Co., desired.

To those of you in the scientific world who think Newton little short of divine, I issue the above clear-cut challenge.

MAURICE JETER, Salem, Va.

RAINING STARS

Editor, SCIENCE AND INVENTION:

Will you please answer the following question: Was there a day in the month of May, 1836, that the sun went black and it rained stars. It is argued here that it is quoted by the Bible as to happen at the time.

JOHN DYE, St. Louis, Mo.

(The latest date quoted in the Bible A. D. 96, according to the Bishop Ussher cronology. Consequently, it would be impossible for the Bible to mention an event happening in the new period in the year 1836, except as an indefinite prediction.

There was an eclipse in the year 1836 which was not a total eclipse but an annular one, and it was visible at Edinburg, Scotland. This eclipse played an important role in the development of the then new science of Astrophysics, and it was during this eclipse that Forbes, who was not an astronomer but a stock-broker demonstrated that the "telluric" lines were comparatively few in number and relatively unimportant. During this eclipse the phenomenon known as "Bailey's Beads" was also demonstrated. This eclipse as an annular one was not visible in the United States and did not compare with the eclipse of 1842. Metcoric showers which are seen during a semi-eclipse but better during a total eclipse and during certain days of the year may have been likened to "raining stars."

We never see a shower of stars. All of the visible stars are greater in diameter than our sun. In popular language folk very often call meteoric showers, shooting stars. It is clear, therefore, that those who argue the way you have explained are incorrect in their statements. No eclipse was visible in St. Louis during the year indicated by you.—EDITOR.)

DISLIKES SCIENCE

Editor, SCIENCE AND INVENTION:

A young man in my home who is eager for knowledge and wisdom subscribes for many magazines, among them being SCIENCE AND INVENTION and RADIO NEWS. He just unfolds and glances at the latest magazines and then places them in my room "to read and pass on." I don't wonder that he spends no time reading them since today I read that sickening story in part of "Tarrano The Conqueror;" I also noted prizes for Matchcraft, a fine means for those of little brain to spend time on non-constructive work. Most of the stuff in your magazine would absorb soul and body with mad house stuff and as to Dr. O'Conor Sloane having to fall back on tortures of long ago for more brain shock, I'll just say that I shall light my open grate-fire with your stuff. It is worse than useless, it is destructive.

OLIVIA KINGSLAND,
San Jose, Calif.

(For every knock on the story "Tarrano The Conqueror" which we have received, we have also heard from thousands of readers to whom this story appealed. We must please the majority and we find that "Tarrano The Conqueror" was liked very much by our readers.

Your statement to the effect that those of little brain power build Matchcraft models is not borne out in practice. Were you able to glance at some of the excellent and in fact remarkable models constructed entirely of matches or had you examined the photographs of the Matchcraft Contest prize awards you would have seen that it takes more than a little brain power to assemble the matches so as to make the various articles from these little wooden splints. It requires an intense amount of brain power to sit quietly at the task, molding the matches into various structures. It requires the knowledge of the the handling of tools to enable you to make your model look presentable. It requires the infinite patience and care in whittling matches to fit the constructions and in devising methods for hastening the completion of the work. It enables a man who may be crippled to sit down and tinker with a model for months so that his time no longer passes wearily. Your communication mailed in the envelope of the Lighthouse Church indicates to us that you are undoubtedly affiliated with the Grace Baptist Church, or at least a member of the congregation there. As such a member, you should know that anything which will help luckless individuals is uplifting. Of course your membership with this organization is an assumption on our part.

Doesn't it thrill you to know that the world in general has been advanced in its civilization from the days of torture. The torture articles are no longer being published. We have completed the series, although we could have illustrated many far more gruesome than those which we published. Today our tortures are almost as bad. We have the garrote in Spain, the guillotine in France, the hangman's noose in England and in America, the electric chair, the lethal gas chamber, shrapnel, bombs, liquid fire, machine guns; the submarine ruthlessly killing thousands with one torpedo; the airplane which could snuff out the lives of an entire city and burn up the population if it so desired. Are we more civilized in our present third degree methods than the ancients were in their's? We question a man until he is so weak from hunger, thirst and from want of sleep that he will admit anything and frequently we strike him on the head with a rubber hose to make him "come across" quicker.

Of course you do not like to hear all this, the truth usually hurts. Frequently our uplift societies carry on their work in circles where it will obtain the most publicity and advocate reforms which produces a bad taste in the mouths of the populace in general. There are many movements which could well be dispensed with and many which could be initiated, but the latter do not carry as much distinction with them, they do not mean as much to the leader of the movement.

And this answer will probably give you another brain shock.—EDITOR.)

AMAZING STORIES

IN OUR FEBRUARY ISSUE:

THE LAND THAT TIME FORGOT, by Edgar Rice Burroughs (A Serial in Three Parts—Part One). The editors do not remember ever having read a more exciting and all-absorbing story than the present one, by this master of fiction, the creator of the Tarzan tales. If you want to be thrilled through and through, do not miss this story.

NEW STOMACHS FOR OLD, by W. Alexander. For some time a new technique has been built up by surgeons and biological experimenters; that is, successfully transplanting animal organs from one animal into another. But substituting one man's stomach for another is even today a large order, though not at all impossible. What surprises might be in store when it will finally be done, is related vividly by our new author.

THE ELEVENTH HOUR, by Edwin Balmer and William B. MacHarg. Here is another one of the famous scientific detective stories by the well-known authors. There is good science and plenty of excitement in this short tale, and you will not know the full solution until the end.

THE THOUGHT MACHINE, by Ammianus Marcellinus in which the author gives some very interesting possibilities resulting from the invention of a perfect machine that can solve—adequately and in record time—all man's problems.

THE FIRST MEN IN THE MOON, by H. G. Wells. After you have read this month's installment you will naturally be keyed up for the finish, which will be given to you in large and forceful doses in the final chapters next month.

THE SECOND DELUGE, by Garrett P. Serviss. In the closing chapters we find the exposé of a great mystery. Cosmo Versál knows that the entire world must be submerged, for did he not see the very pinnacle of the Himalayas disappear under water? But nature has strange ways and the unexpected, as usual, promptly turns up. One of the greatest surprise endings that we have ever seen.

A SURE ALARM CLOCK

Editor SCIENCE AND INVENTION:

In the October number of SCIENCE AND INVENTION on page 522, or the Wrinkles, Recipes & Formulas section appeared a very ingenious idea for limiting the time which an alarm clock will ring when it fulfills its task in the early watches of the morning. This idea appealed to me and I have doctored my spring so that my clock will ring just four seconds. This is enough to waken me, because I'm a light sleeper.

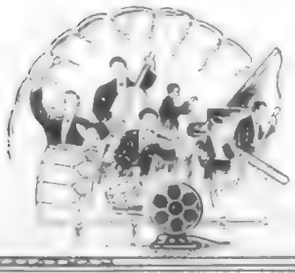
Since then I have heard two stories of college men who were just the opposite. One man in an adjacent dormitory has his room-mate *hide* his alarm clock so that he will have to get up and hunt it in the morning to insure his getting out of bed on time. Another man of his acquaintance has six alarm clocks in his room, each one is set so that it will start to ring five minutes after the one that precedes it starts to ring. Thus he has at least thirty minutes of ringing and he usually gets out on time. With these examples I think you ought to call on your inventive readers.

FRANK M. ELLIS, Pittsburgh, Penna.

(One of the best methods of awakening a very heavy sleeper and getting him into the habit of actually leaping out of bed in the morning is to have his room-mate or a friend enter the room when the alarm rings and pull the blankets off the sleeper and upset the bed, throwing him out. After he has received treatment of this nature for a few weeks, he will jump out of bed the very instant the alarm rings. This method worked in the U. S. Army with a great deal of satisfaction. The first man up used to go through the barracks and toss everyone else out of bed.

Another very good method which can be employed if the individual is a heavy sleeper, and he has no comrade to perform the expulsion act, is to place a bath spray over the head of the bed and connect this with a pail and siphon arrangement. When the alarm clock goes off, the pinchcock around the rubber hose is opened and the sleeper gets a shower-bath. The amount of water should be so regulated that the bed clothes will not be damaged. Several of these treatments and the individual is sure to leap out of bed the very instant the alarm goes off. Disregard for an alarm clock sound is generally cultivated. If the individual is hard of hearing, the disregard is of course excusable. Any very heavy sleeper can be made to respond to the sound of an alarm clock if a very disagreeable situation will be produced immediately after the clock sounds. Let us hope that the unfortunate gentlemen mentioned in your letter will have willpower enough to try to enforce the remedies outlined.—EDITOR)

(Continued on page 956)

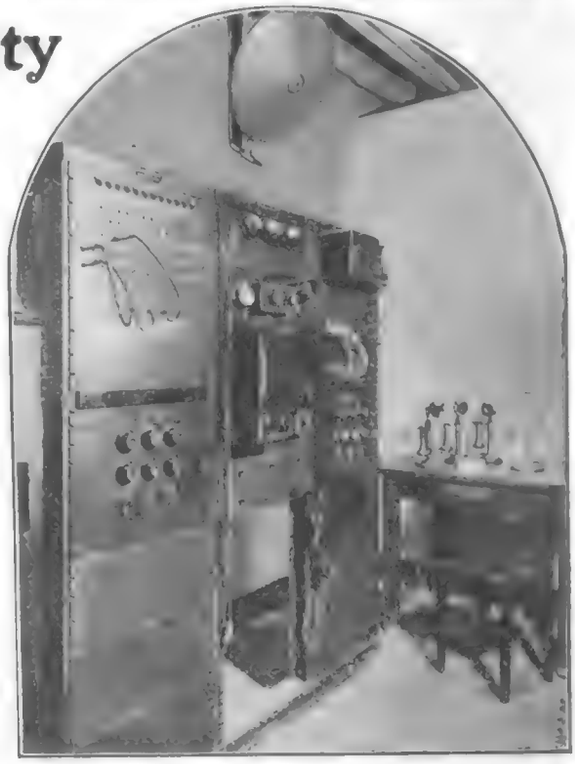


RADIO

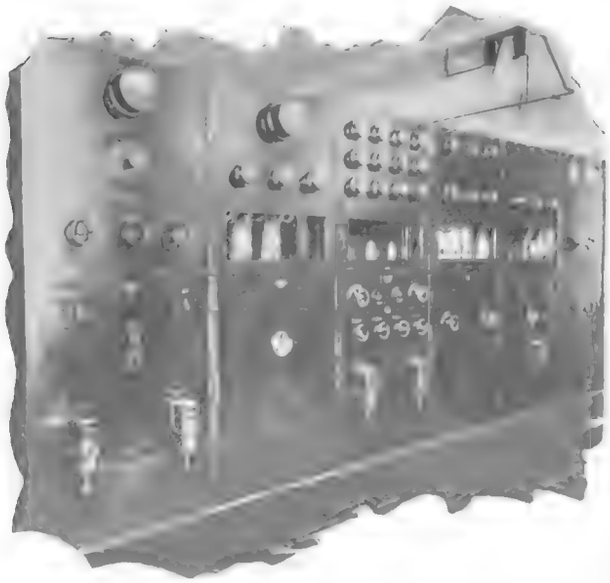
WABC Opens in New York City

Uses Latest 5 K.W. Superpower Transmitter

THE new studio, occupying the top floor of Steinway Hall on West 57th St., New York City. This is the largest studio used by any broadcasting station in the country, and is particularly adapted for the convenience of symphony orchestras, bands, and other large groups. The acoustics are perfect for this type of work, and no expense has been spared in approaching perfection. The studio is well ventilated, which is quite unusual in our broadcasting experience, and, as may be seen above, it is well lighted by large windows.



THE control room at WABC is equipped to handle a large number of remote pick-up lines, and is also arranged so that several broadcasting stations in the Atlantic Broadcasting Company's group may be hooked up with either of the studios in the Steinway Building. This is the very latest in control equipment for broadcast stations.



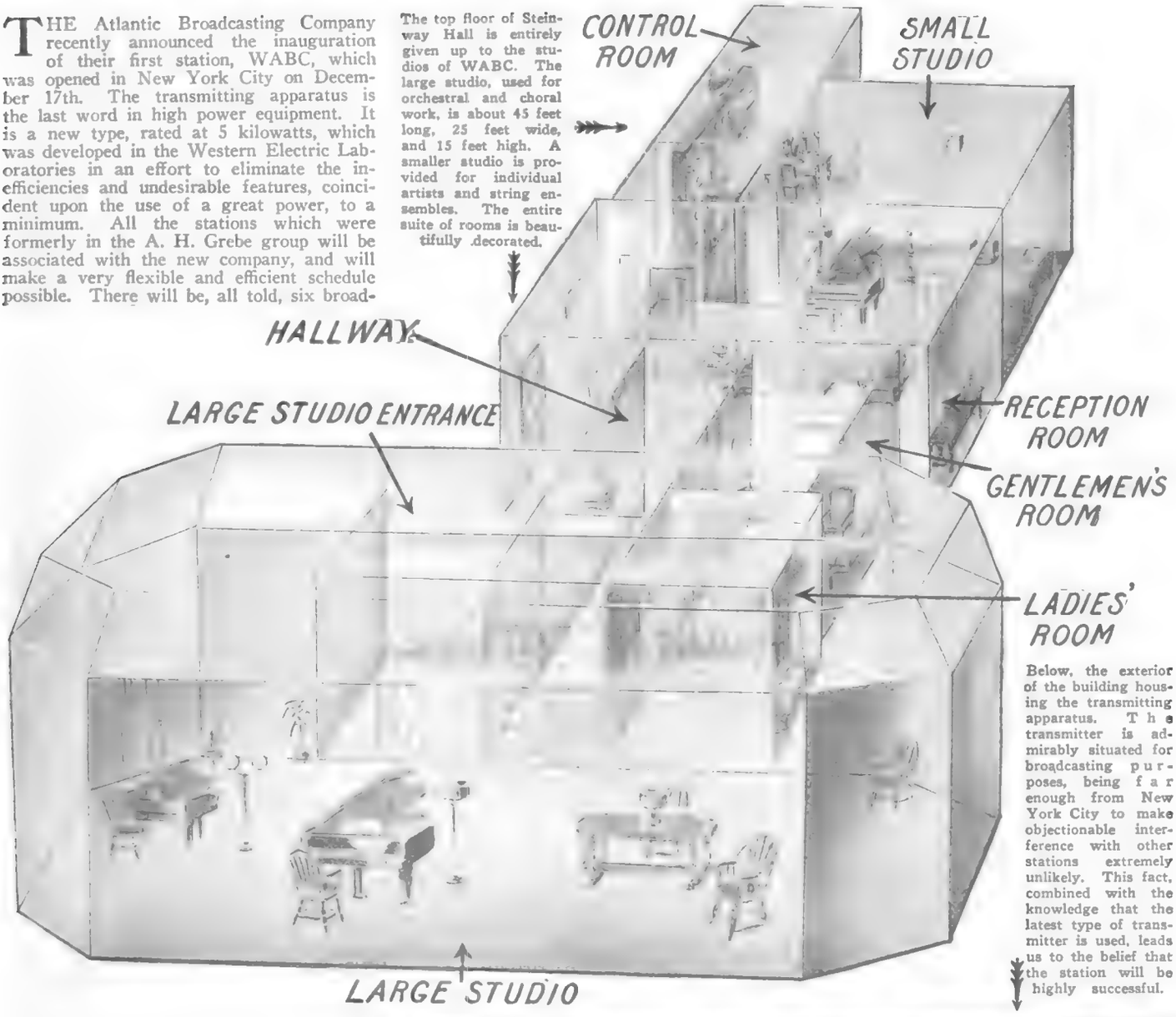
ONE of the panels of the transmitter, which is located at the factory of the A. H. Grebe Co., Inc., at Richmond Hill, L. I. This equipment was originally installed for the use of station WAHG, but was recently purchased by the Atlantic Broadcasting Company, of which Alfred H. Grebe is President, for the inauguration of their new chain of broadcasting stations. The 5-kilowatt transmitter above was especially designed for this station and installed at an expense of $167,000.

THE interior of the 5-kilowatt transmitter of WABC. It has been found in the past that high power transmitters in the metropolitan district tended to blanket the entire area, making it impossible for the average listener to tune out the superpower station. The Western Electric Company, in designing this particular transmitter, strove to eliminate this highly undesirable feature, and there is no doubt that the latest developments have been incorporated in this new station.

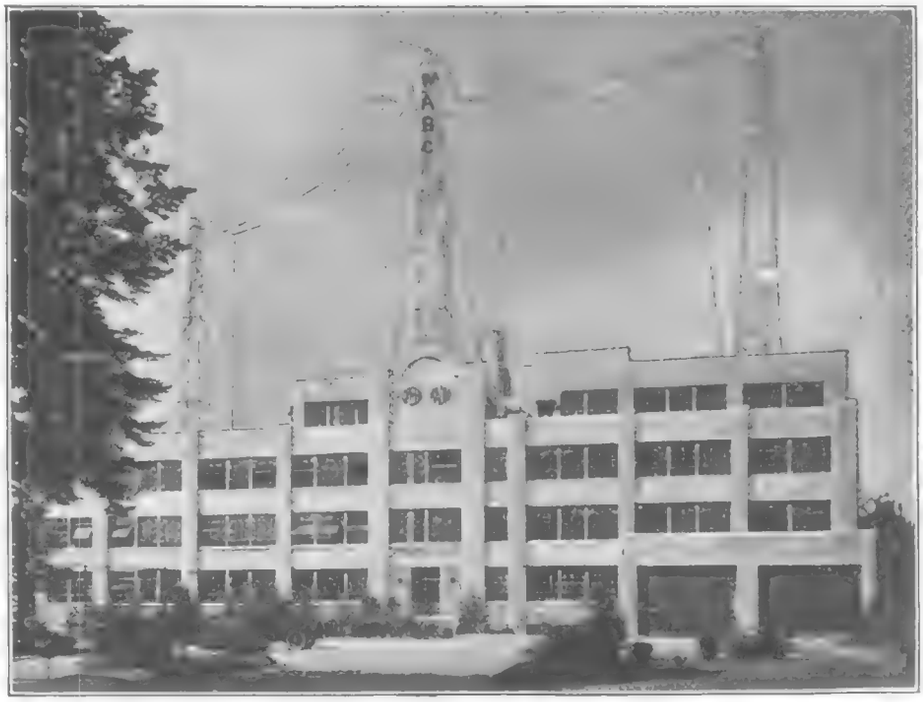
The Latest in Studios and Equipment

THE Atlantic Broadcasting Company recently announced the inauguration of their first station, WABC, which was opened in New York City on December 17th. The transmitting apparatus is the last word in high power equipment. It is a new type, rated at 5 kilowatts, which was developed in the Western Electric Laboratories in an effort to eliminate the inefficiencies and undesirable features, coincident upon the use of a great power, to a minimum. All the stations which were formerly in the A. H. Grebe group will be associated with the new company, and will make a very flexible and efficient schedule possible. There will be, all told, six broadcasting stations of various types in use. The largest unit, WABC-WAHG, operating on 315.6 meters wavelength, with a power of 5,000 watts, will be permanently identified with the studio and transmitter shown in these photographs. Two experimental stations are to be operated, 2XE and 2ZV, each having variable power and wavelength assignments. There will be one more large transmitter in the metropolitan area, WBOQ, operating on a wavelength of 236 meters with an output of 1,000 watts. WGMU, the much-spoken-of Grebe mobile station, which is installed on the chassis of a high-speed truck, will use 100 watts power and a wavelength of 63-105 or 236 meters, as the occasion may demand. A marine station, WRMU, installed on an express cruiser, which may be sent to points of interest along the coast, will broadcast on the same wavelengths, with a power of 200 watts. These last two portable transmitters will probably be used to transmit programs on a low wavelength to the larger stations, where they may be rebroadcast on the regular schedules. A perspective view of the studio in New York City is shown on this page, which will afford a good idea of the appointments to be expected in this modern broadcasting institution to be operated by the Atlantic Broadcasting Company.

The top floor of Steinway Hall is entirely given up to the studios of WABC. The large studio, used for orchestral and choral work, is about 45 feet long, 25 feet wide, and 15 feet high. A smaller studio is provided for individual artists and string ensembles. The entire suite of rooms is beautifully decorated.



Below, the exterior of the building housing the transmitting apparatus. The transmitter is admirably situated for broadcasting purposes, being far enough from New York City to make objectionable interference with other stations extremely unlikely. This fact, combined with the knowledge that the latest type of transmitter is used, leads us to the belief that the station will be highly successful.



Constructing An "N" Circuit Receiver

Sir Oliver Lodge's Latest Set as Built by SCIENCE AND INVENTION

By JAMES FRANCIS CLEMENGER

Fig. 1. The panel of the set as constructed in our laboratories was laid out so that it would present an attractive appearance.

EVERY once in a long while something really new is developed in radio, but more often than not that which is thought to be new is simply found to be a revival of an old idea or an adaptation of a more or less well-known principle. A few years ago the radio fraternity hailed with delight the announcement that something really new had been discovered in the way of radio circuits, when Prof. Hazeltine perfected his first neutrodyne set. Further back than that, Armstrong's regenerative circuits and DeForest's ultra audion circuit were the sensations of their day. Now comes a new circuit from across the sea which promises to cause as much of a revolution in popular design as did its predecessors.

At the Radio Exposition held at Olympia, near London, about a month ago, a new set was presented for the first time for which its makers claimed many important advances. The circuit incorporated in the set was the invention of Sir Oliver Lodge, F.R.S., who is known far and wide as one of Britain's ablest scientists. Two weeks after the first set was publicly exhibited in London, SCIENCE AND INVENTION Magazine published the first thorough article to be seen in this country. The novelty of the set appealed to the editors of this publication, and it was decided that it would be wise to cover the subject in two articles. One, giving the theory of the circuit, appeared in the Dec. issue, and this article covers its practical development.

THE CIRCUIT

As the theory governing the operation of the new circuit was thoroughly gone into in the December number, it should not be necessary to repeat that portion of the story. In laboratory tests, it was found that the "N" circuit was adaptable to numerous variations, each of which had some common and some individual characteristics. The circuit which was finally adopted for construction is essentially similar to that used in the commercial production of this set by a British firm. Referring to Fig. 4, it is seen that the circuit consists of a detector and three stage resistance coupled amplifier, using a variation of the single circuit antenna familiar to all radio fans. In the diagram L1 and L2 are coils of about .2 microhenries, comprising about 55 turns of No. 24 wire wound on a 3" coil. It should be noted here that the circuit may be broken at the point marked X in the grid and filament circuits, and any of the standard antenna tuning circuits may be connected to these leads.

The oscillatory circuit, represented by the coil L2 and a .0005 microfarad variable condenser shunted across it, is the essential portion of the "N" circuit which gives the set its unusual characteristics. The grid condenser is of the standard .00025 microfarad variety, while the grid leak is preferably variable between the limits required by the detector tube used. A .0001 microfarad fixed condenser is shunted as shown across the oscillatory "N" circuit to the plate of the detector tube.

The resistance coupled amplifier selected for this particular unit is worthy of particular notice, inasmuch as it was found to be the most efficient and satisfactory of a number tested by our laboratories. It is not essential, however, that the same make be used, in fact it is quite possible to use any one of the standard amplifier circuits.

IN the December number, an authorized article on the theory of Sir Oliver Lodge's "N" circuit was presented by the Radio Editor. At that time it was announced that a full constructional article would be prepared for the present issue, with a view toward adapting the design of the set to conditions encountered in the reception of radio broadcasting in this country.

The set described here was designed and built under the immediate supervision of the writer, and while improvements are possible and to some extent advised, it is felt that the set will give very surprisingly excellent results to those who care to construct it.

—THE EDITOR.

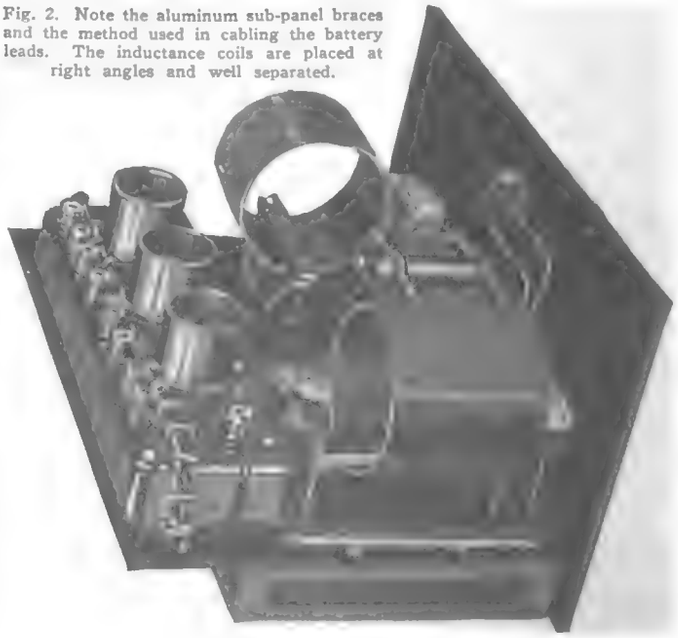
Naturally it is understood that resistance-coupled amplification affords a finer reproduction of the signal, although at the expense of one more tube to drain current from the A battery. It is of interest to note that the price of the parts for an amplifier such as that used here may be purchased for about $3.00, and that a highly efficient manufactured amplifier of the make used may be purchased for about $15.00. Two jacks are provided, J1 for the detector tube, and J2 for the final amplifier output. R2 is a rheostat controlling the filament of the detector tube, while R3 is a rheostat which controls the filaments of all the amplifier tubes. Sw. indicates an "A" battery switch. A .002 microfarad fixed condenser is shown shunted across the detector jack to act as a by-pass when telephones are used. A corresponding condenser is included in the amplifier unit, indicated by C1. The fixed condensers C2, C3 and C4 are preferably of the capacity of about .1 microfarads, to attain which capacity they must be purchased in the form of the "can" condenser, using paper dielectric. They may, however, be mica condensers of .01 microfarads or greater capacity. R4, R6 and R8 are fixed resistances of about 250,000 ohms. R5, R7 and R9 are of the same type, excepting that their resistance is 500,000 ohms. It should be noted that a C battery is provided for the last amplifier tube to prevent distortion from overloading.

THE LAYOUT

Inspection of the photograph, Fig. 5, will give a good idea of the layout used in constructing the set for this article. Note that the general effect is that of simplicity and that the parts are arranged so as to insure the obtaining of the maximum of efficiency. The layout is symmetrically arranged to give the best appearance.

The coil at the left is the one marked L2 in the diagram, while the other is that marked L1. The rheostat for the detector is directly in front of the antenna coil, that of the amplifier being in front of the oscillator coil. The .0005 microfarad variable condenser tuning the oscillatory circuit is placed in the center of the assembly, with the detector tube socket directly behind it. The amplifier unit is placed at the rear of the sub-panel, part of its binding posts being used for direct battery connection. Reading from left to right in the photograph, the binding posts on the amplifier unit are as follows: C—, A— and C+, A+, B—, B+ 90, B+135, and the two output posts. Of these the B battery and C battery posts alone are used direct. The A battery leads are conducted to a pair of binding posts on a strip fastened at the rear of the brackets under the sub-panel, and the output posts are connected to the amplifier jack. The knob which shows immediately to the left of the detector tube socket is used to control the graphite compression grid leak. This, together with the grid condenser and the .0001 condenser which is shunted from the oscillatory circuit to the plate, is placed under the sub-panel to aid in preserving the neatness of appearance which is so desirable. The high potential end of the oscillatory coil, L2, in other words that end

Fig. 2. Note the aluminum sub-panel braces and the method used in cabling the battery leads. The inductance coils are placed at right angles and well separated.



which is connected to the grid condenser of the detector tube, is placed so that it is farthest from the frame of the variable condenser. This is done to reduce losses by absorption which might be occasioned by the presence of the metal frame in the field of the oscillatory coil. The two jacks and the filament switch are all located under the sub-panel with a view towards shortening leads. The peculiar looking mechanism immediately above the variable condenser is the rear of the socket which holds the lamp for the illumination of the dial.

It is worthy of note that the leads from the instruments which are mounted on the panel were all made with spaghetti covered bus bar, the bends being made with care so as to lead the wires vertically through holes drilled in the sub-panel, while the wiring under the sub-panel was done with spaghetti covered No. 18 soft copper wire, using the "catch-as-catch-can" system. In other words the latter leads were carried in the most direct manner, regardless of turns and twists. The leads from the binding posts on the amplifier unit were cabled and wrapped, then carried through holes drilled in the sub-panel to their respective instruments. In laying out the panel, it will be found wise to adjust the positions of the various dials and knobs according to the particular size used, so as to provide for as symmetrical an appearance as possible.

THE SELECTION OF PARTS

In designing this set, very careful consideration was given to the selection of the components, with a result that the set contains parts which are of the highest quality available. It is obviously impossible to mention the manufacturers' names in an article of this type, but if our recommendations would be of interest, the names of the parts used in this set may be obtained free of charge by addressing the Radio Editor. The condenser used is of a type known as straight-line-tuning, to differentiate it from the other three types, known respectively as straight - line - frequency, -capacity, and -wavelength. It is found that this type of condenser, as well as having almost perfect electrical characteristics, combines the efficient ranges of the other three types, while it eliminates their bad spots. The tuning coils used are of a type commercially manufactured and furnished to experimenters in 20-inch lengths to be cut to the required size. The coils are space wound of No. 26 double silk covered wire shrunk on a celluloid form, and may be mounted, as was done here, on bakelite strips. The inductance of this type of coil is approximately .1 millihenry per inch of length in the 3-inch diameter size. The two rheostats and the grid leak are of the graphite compression type selected because of their compactness and efficiency. The amplifier unit has been spoken of before, but it is worthy of notice from the standpoint of appearance as well as that of high efficiency. It was considered advisable to include a unit amplifier rather than one specially assembled so that the simplicity of the original set might be enhanced. It is to be understood that it is not essential that the parts shown in the photographs be used with this circuit, as this apparatus was simply selected for its high efficiency and reliability, and its selection does not exclude other makes from consideration.

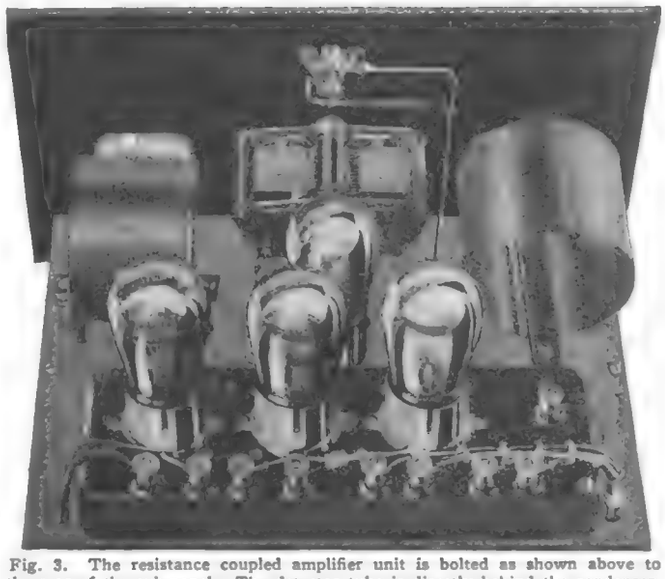


Fig. 3. The resistance coupled amplifier unit is bolted as shown above to the rear of the sub-panel. The detector tube is directly behind the condenser.

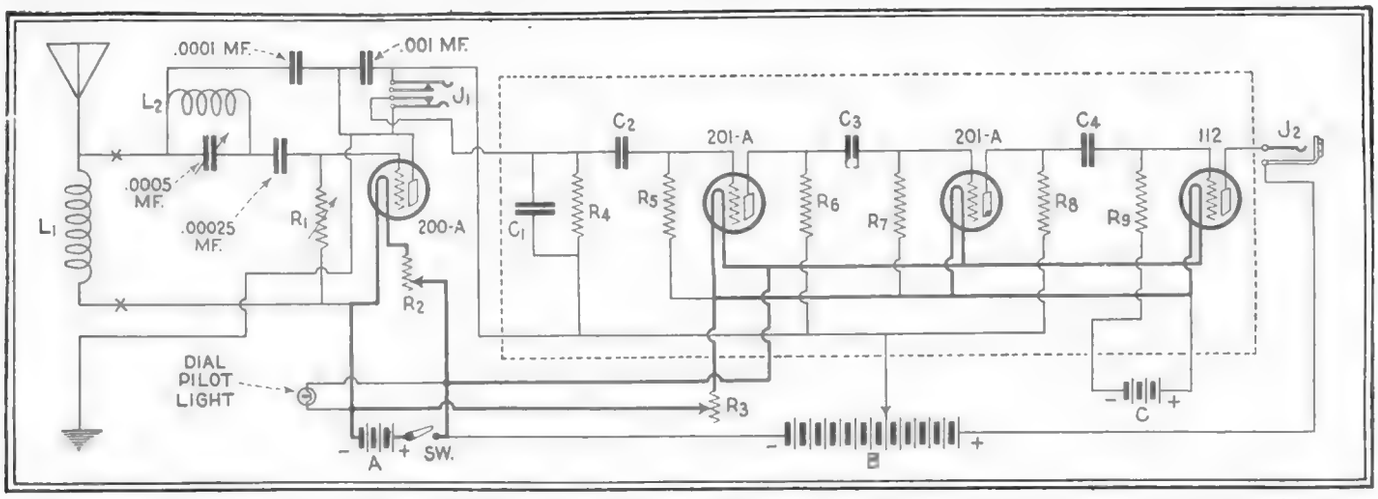


Fig. 4. The circuit given here is but one of a large number which might have been used with the "N" circuit, but it was selected in this case because of its simplicity. If the leads are cut at points (X), any of the standard antenna circuits may be substituted. The parts contained in the resistance coupled amplifier unit are all within the dotted line. See the December article for suggestions as to other circuits which may be used.

OPERATION OF THE SET

Due to the fact that the set has only one control it is obviously unnecessary to go into any detailed explanation of how it should be operated. If the set is constructed according to directions, it will be found impossible to make it oscillate, and as a result there can be no interference with your neighbor's enjoyment of his program through radiation from your antenna. It is recommended that the type 200-A gas-content tube be used in the detector socket and the type 112 power amplifier in the last stage of audio frequency. The other two stages of audio frequency may use either the type 201-A tubes or one of the special High-Mu tubes designed especially for resistance-coupled amplifiers.

In testing the set in our laboratories, at a distance of approximately half a mile from WEAF, it was found that the set had peculiar characteristics in tuning. The peak of the wave, i.e. the point at which the signal came in with full volume, covered only about three degrees of the dial, but due to its high power and its nearness, the station came in weakly with uniform amplitude over the entire range of the dial, forming a faint "background" of sound; found not to interfere to any great extent with the enjoyment of reception, as the interference could be practically eliminated by reducing the filament current of the detector tube. If strong interference is caused [illegible] high powered station, it [illegible] trap be inserted i[illegible] out the undesired

(*Continu*

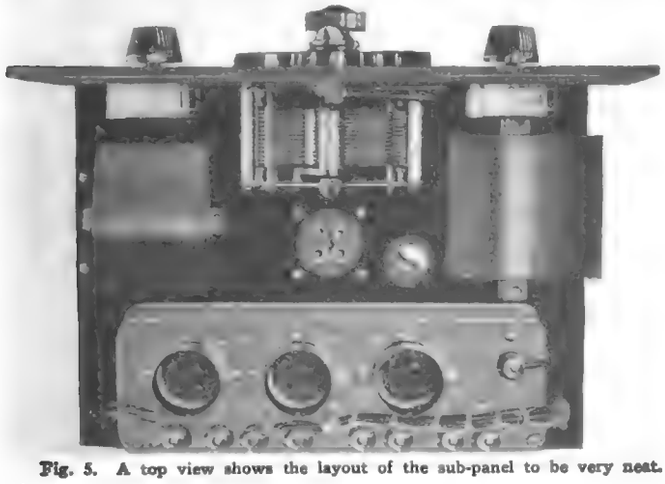


Fig. 5. A top view shows the layout of the sub-panel to be very neat.

List of Broadcast Stations in the United States

Radio Call Letter	BROADCAST STA. Location	Wave (Meters)	Power (Watts)
KDKA,	East Pittsburgh, Pa.	*309.1	Var.
	(Various short-wave transmissions)		
KDLR,	Devils Lake, N. D.	231	5
KDYL,	Salt Lake City, Utah	216	200
KFAB,	Lincoln, Neb.	*340.7	5000
KFAD,	Phoenix, Ariz.	273	500
KFAF,	San Jose, Calif.	217.3	50
KFAU,	Boise, Idaho	280.2	2000
KFBB,	Havre, Mont.	275	50
KFBC,	San Diego, Calif.	380	50
KFBK,	Sacramento, Calif.	535	100
KFBL,	Everett, Wash.	224	100
KFBS,	Trinidad, Colo.	238	15
KFBU,	Laramie, Wyo.	375	500
KFCB,	Phoenix, Ariz.	238	125
KFDD,	Boise, Idaho	275.1	50
KFDM,	Beaumont, Tex.	315.6	500
KFDX,	Shreveport, La.	250	100
KFDY,	Brookings, S. Dak.	299.8	100
KFDZ,	Minneapolis, Minn.	231	10
KFEC,	Portland, Ore.	252	50
KFEL,	Denver, Colo.	254	250
KFEQ,	Oak, Nebr.	268	500
KFEY,	Kellogg, Idaho	253	10
KFFP,	Moberly, Mo.	242	50
KFGQ,	Boone, Iowa	226	10
KFH,	Wichita, Kans.	*267.7	500
KFHA,	Gunnison, Colo.	252	50
KFHL,	Oskaloosa, Iowa	240	10
KFI,	Los Angeles, Calif.	467	5000
KFIF,	Portland, Ore.	248	100
KFIO,	Spokane, Washington	273	500
KFIQ,	Yakima, Wash.	256	500
KFIU,	Juneau, Alaska	226	10
KFIZ,	Fond du Lac, Wis.	273	100
KFJB,	Marshalltown, Iowa	248	10
KFJF,	Oklahoma City, Okla.	261	500
KFJI,	Astoria, Ore.	246	10
KFJM,	Grand Forks, N. Dak.	278	100
KFJR,	Portland, Ore.	263	120
KFJY,	Fort Dodge, Iowa	246	50
KFJZ,	Fort Worth, Tex.	254	50
KFKA,	Greeley, Colo.	*272.6	50
KFKB,	Milford, Kas.	131.4	1000
KFKU,	Lawrence, Kans.	275	500
KFKX,	Hastings, Nebr.	288.3	5000
KFKZ,	Kirksville, Mo.	225.4	50
KFLR,	Albuquerque, N. Mex.	254	100
KFLU,	San Benito, Tex.	236	20
KFLV,	Rockford, Ill.	229	100
KFLX,	Galveston, Tex.	240	250
KFMR,	Sioux City, Iowa	261	100
KFMX,	Northfield, Minn.	336.9	500
KFNF,	Shenandoah, Iowa	161.3	2500
KFOA,	Seattle, Wash.	454.3	1000
KFOB,	Burlingame, Calif.	226	50
KFON,	Long Beach, Calif.	233	500
KFOR,	David City, Nebr.	226	100
KFOT,	Wichita, Kans.	251	50
KFOX,	Omaha, Nebr.	248	100
KFOY,	St. Paul, Minn.	252	50
KFPL,	Dublin, Texas	242	20
KFPM,	Greenville, Texas	242	10
KFPR,	Los Angeles, Calif.	230.6	500
KFPW,	Carterville, Mo.	258	20
KFPY,	Spokane, Wash.	273	100
KFQA,	St. Louis, Mo.	280.2	5000
KFQB,	Fort Worth, Texas	508.2	2500
KFQD,	Anchorage, Alaska	227.1	100
KFQP,	Iowa City, Iowa	224	10
KFQU,	Alma (Holy City) Calif.	231	250
KFQW,	Seattle, Wash.	215.7	50
KFQX,	Seattle, Wash.	210	15
KFQZ,	Hollywood, Calif.	225.4	500
KFRB,	Beeville, Tex.	248	250
KFRC,	San Francisco, Calif.	267.7	50
KFRU,	Columbia, Mo.	*199.7	500
KFRW,	Olympia, Wash.	248.8	50
KFSD,	San Diego, Calif.	245.8	1000
KFSG,	Los Angeles, Calif.	275	500
KFUL,	Galveston, Tex.	258	500
KFUM,	Colorado Springs, Colo.	239.9	100
KFUO,	St. Louis, Mo.	545.1	500
KFUP,	Denver, Colo.	234	50
KFUR,	Ogden, Utah	224	50
KFUS,	Oakland, Calif.	256	50
KFUT,	Salt Lake City, Utah	263	100
KFUU,	Oakland, Calif.	220	100
KFVD,	Venice, Calif.	268	50
KFVE,	St. Louis, Mo.	240	5000
KFVG,	Independence, Kas.	236	15
KFVI,	Houston, Texas	239.9	50
KFVN,	Fairmont, Minn.	227	50
KFVR,	Denver, Colo.	244	50
KFVS,	Cape-Girardeau, Mo.	*223.7	50
KFVY,	Albuquerque, N. Mex.	250	10
KFWB,	Hollywood, Calif.	252	500
KFWC,	San Bernardino, Calif.	291.1	200
KFWF,	St. Louis, Mo.	244.2	250
KFWH,	Eureka, Calif.	254	100
KFWI,	San Francisco, Calif.	250	500
KFWM,	Oakland, Calif.	325.9	500
KFWO,	Avalon, Calif.	244.1	250
KFWU,	Pineville, La.	238	100
KFWV,	Portland, Ore.	242.6	50
KFXB,	Big Bear Lake, Calif.	262.6	500
KFXD,	Logan, Utah	265.4	10
KFXF,	Denver, Colo.	250.1	1000
KFXH,	El Paso, Texas	242	50
KFXJ,	Edgewater, Colo.	215.7	15
KFXR,	Oklahoma City, Okla.	244.2	15
KFXY,	Flagstaff, Ariz.	265.4	50
KFYF,	Oxnard, Calif.	242.2	10
KFYJ,	Houston, Texas (portable)	238	10
KFYO,	Texarkana, Tex.	269.7	10
KFYR,	Bismarck, N. Dak.	248	10
KGAR,	Tucson, Ariz.	245.8	500
KGBS,	Seattle, Wash.	227	100
KGBU,	Ketchikan, Alaska	229	500
KGBX,	St. Joseph, Mo.	317.8	50
KGBY,	Shelby, Neb.	202.6	50
KGBZ,	York, Neb.	333.1	100
KGCA,	Decorah, Ia.	280.2	20
KGCB,	Oklahoma City, Okla.	331	100
KGCG,	Newark, Ark.	229.9	100
KGCH,	Wayne, Neb.	434.5	500
KGCI,	San Antonio, Tex.	239.9	15
KGCL,	Seattle, Wash.	238	10
KGCN,	Concordia, Kas.	240	50
KGCR,	Brookings, S. D.	252	10
KGCU,	Mandan, N. D.	285	100
KGCX,	Vida, Mont.	240	8
KGDA,	Dell Rapids, S. Dak.	254.1	15
KGDE,	Barrett, Minn.		
KGDI,	Seattle, Wash.	416.4	
KGDJ,	Cresco, Iowa	202.6	
KGDM,	Stockton, Calif.	217.3	
KGDO,	Dallas, Tex.	285	100
KGDP,	Pueblo, Colo.	260.7	10
KGDR,	San Antonio, Tex.	240	15
KGEA,	Seattle, Washington	345	15
KGO,	Oakland, Calif.	*361.2	5000
KGRS,	Amarillo, Tex.	234	125
KGTT,	San Francisco, Calif.	206.8	50
KGU,	Honolulu, Hawaii	270	500
KGW,	Portland, Ore.	491.5	1000
KGY,	Lacey, Wash.	278.8	50
KHJ,	Los Angeles, Calif.	405.2	500
KHQ,	Spokane, Wash.	394.5	1000
KHX,	Los Angeles, Calif. (port.)	119.9	500
KICK,	Anita, Ia.	273	100
KJBS,	San Francisco, Calif.	224.2	5
KJR,	Seattle, Wash.	384.4	1000
KLDS,	Independence, Mo.	*440.9	1000
KLS,	Oakland, Calif.	250	250
KLX,	Oakland, Calif.	508.2	500
KLZ,	Denver, Colo.	384.4	500
KMA,	Shenandoah, Iowa	161	500
KMJ,	Fresno, Calif.	234	50
KMJP,	Kansas City, Mo.	440.9	1000
KMMJ,	Clay Center, Neb.	228.9	1000
KMO,	Tacoma, Wash.	250	100
KMOX,	Kirkwood, (St.Lo.) Mo.	280.2	5000
KMTR,	Hollywood, Calif.	272.2	500
KNRC,	Santa Monica, Calif.	238	500
KNX,	Los Angeles, Calif.	336.9	500
KOA,	Denver, Colo.	*322.4	5000
KOAC,	Corvallis, Ore.	280.2	500
KOB,	State College, N. M.	348.6	5000
KOCH,	Omaha, Neb.	258	500
KOCW,	Chickasha, Okla.	252	200
KOIL,	Council Bluffs, Iowa	305.9	500
KOIN,	Sylvan, Ore.	319	1000
KOMO,	Seattle, Wash.	305.9	1000
KOWW,	Walla Walla, Wash.	285.5	500
KPJM,	Prescott, Ariz.	215	
KPO,	San Francisco, Calif.	*428.3	1000
KPPC,	Pasadena, Calif.	229	50
KPRC,	Houston, Texas	296.9	500
KPSN,	Pasadena, Calif.	315.6	1000
KQV,	Pittsburgh, Pa.	275	500
KQW,	San Jose, Calif.	333.1	500
KRAC,	Shreveport, La.	220	50
KRE,	Berkeley, Calif.	256	100
KRLD,	Dallas, Tex.	353	500
KRSC,	Seattle, Wash.	199.6	250
KSAC,	Manhattan, Kansas	340.7	500
KSBA,	Shreveport, La.	260.7	1000
KSD,	St. Louis, Mo.	545.1	500
KSEI,	Pocatello, Ida.	260.7	500
KSL,	Salt Lake City, Utah	299.8	1000
KSMR,	Santa Maria, Calif.	282.8	100
KSO,	Clarinda, Iowa	405.2	500
KSOO,	Sioux Falls, S. D.	360	100
KTAB,	Oakland, Calif.	302.8	1000
KTAP,	San Antonio, Tex.	263	10
KTBI,	Los Angeles, Calif.	293.9	750
KTBR,	Portland, Ore.	263	50
KTHS,	Hot Springs, Ark.	*374.8	1000
KTNT,	Muscatine, Iowa	353.1	1000
KTUE,	Houston, Tex.	263	5
KTW,	Seattle, Wash.	454.3	1500
KUOA,	Fayetteville, Ark.	299.8	750
KUOM,	Missoula, Mont.	211	250
KUSD,	Vermillion, S. D.	278	500
KUT,	Austin, Texas	231	500
KVI,	Tacoma, Wash.	322.5	15
KVOO,	Bristow, Okla.	374.8	1000
KVOS,	Seattle, Wash.	333.1	500
KWCR,	Cedar Rapids, Iowa	200	500
KWG,	Stockton, Calif.	248	50
KWKC,	Kansas City, Mo.	236	100
KWSC,	Pullman, Wash.	318.6	500
KWTC,	Santa Ana, Calif.	263	15
KWUC,	Le Mars, Iowa	252	50
KWWG,	Brownsville, Texas	278	500
KXL,	Portland, Ore.	100	50
KXRO,	Seattle, Wash.	240	85
KYW,	Chicago, Ill.	535.4	2000
KZIB,	Manila, P. I.	249.9	20
KZKZ,	Manila, P. I.	270	100
KZM,	Oakland, Calif.	240	100
KZRQ,	Manila, P. I.	400	500
NAA,	Arlington, Va.	*434.5	1000
WAAD,	Cincinnati, Ohio	258	25
WAAF,	Chicago, Ill.	278	500
WAAM,	Newark, N. J.	*263	500
WAAT,	Jersey City, N. J.	225	500
WAAW,	Omaha, Neb.	384.4 & 278	500
WABB,	Harrisburg, Pa.	261	10
WABC,	Richmond Hill, N. Y.	215.6	500
WABF,	Kingston, Pa.	440.7	500
WABI,	Bangor, Me.	240	100
WABO,	Rochester, N. Y.	278	100
WABQ,	Haverford, Pa.	395.7	1000
WABR,	Toledo, Ohio	263	50
WABW,	Wooster, Ohio	266.8	50
WARX,	Mount Clemens, Mich.	246	500
WABY,	Philadelphia, Pa.	242	50
WABZ,	New Orleans, La.	275	50
WADC,	Akron, Ohio	258	500
WAFD,	Port Huron, Mich.	275	500
WAGM,	Royal Oak, Mich.	227.5	50
WAGS,	Somerville, Mass.	250	5
WAIT,	Taunton, Mass.	299	10
WAIU,	Columbus, Ohio	293.9	1000
WAMD,	Minneapolis, Minn.	241	5000
WAPI,	Auburn, Ala.	454.3	1000
WARC,	Medford Hillside, Mass.	261	100
WARS,	Brooklyn, N. Y.	295	500
WASH,	Grand Rapids, Mich.	256.4	500
WATT,	Boston, Mass. (portable	213.8	100
WBAA,	West Lafayette, Ind.	*272.6	250
WBAK,	Harrisburg, Pa.	275	500
WBAL,	Glen Morris, Md.	246	5000
WBAO,	Decatur, Ill.	270	100
WBAP,	Fort Worth, Texas	475.9	1500
WBAW,	Nashville, Tenn.	286.1	100
WBAX,	Wilkes-Barre, Pa.	256	100
WBBC,	Brooklyn, N. Y.	249.9	100
WBBL,	Richmond, Va.	228.9	100
WBBM,	Chicago, Ill.	*225.4	10000
WBBP,	Petoskey, Mich.	238	200
WBBR,	Rossville, N. Y.	416.4	500
WBBW,	Norfolk, Va.	222	50
WBBY,	Charleston, S. C.	208	100
WBBZ,	Chicago, Ill. (portable)	215.7	50
WBCN,	Chicago, Ill.	266	500
WBES,	Takoma Park, Md.	222	100
WBKN,	Brooklyn, N. Y.	291.1	100
WBNY,	New York, N. Y.	322.4	1000
WBOQ,	Richmond Hill, N. Y.	236	100
WBRC,	Birmingham, Ala.	248	50
WBRE,	Wilkes-Barre, Pa.	231	100
WBRL,	Tilton, N. H.	410	500
WBMS,	North Bergen, N. J.	233.7	10
WBRS,	Brooklyn, N. Y.	391	100
WBT,	Charlotte, N. C.	275	250
WBZ,	East Springfield, Mass.	*331.1	5000
WBZA,	Boston, Mass.	*331.1	500
WCAC,	Storrs, Conn.	275	500
WCAD,	Canton, N. Y.	*263	250
WCAE,	Pittsburgh, Pa.	461.3	500
WCAH,	Columbus, O.	265.3	500
WCAJ,	University Place, Neb.	254	500
WCAL,	Northfield, Minn.	336.9	500
WCAM,	Camden, N. J.	336.9	1000
WCAO,	Baltimore, Md.	275	100
WCAR,	San Antonio, Texas	263	5000
WCAT,	Rapid City, S. D.	240	50
WCAU,	Philadelphia, Pa.	277.6	500
WCAX,	Burlington, Vt.	252	100
WCAZ,	Carthage, Ill.	245.8	50
WCBA,	Allentown, Pa.	254	125
WCBD,	Zion, Ill.	344.6	5000
WCBE,	New Orleans, La.	263	5
WCBH,	University, Miss.	242	50
WCBM,	Baltimore, Md.	229	100
WCBR,	Providence, R.I. (port.)	234	100
WCBS,	Providence, R.I. (port.)	242.5	250
WCCO,	Minn.-St. Paul, Minn.	*416.4	5000
WCFL,	Chicago, Ill.	491.5	500
WCFT,	Tullahoma, Tenn.	252	10
WCGU,	Lakewood, N. J.	350.6	500
WCLO,	Camp Lake, Wis.	231	50
WCLS,	Joliet, Ill.	214.2	150
WCMA,	Culver, Ind.	258.5	500
WCOA,	Pensacola, Fla.	252	500
WCRW,	Chicago, Ill.	416.4	50
WCSH,	Portland, Me.	499.7	500
WCSO,	Springfield, Ohio	218	100
WCWK,	Fort Wayne, Ind.	234.2	250
WCWS,	Bridgeport, Conn.	285	500
WCX,	Pontiac, Mich.	516.9	5000
WDAD,	Nashville, Tenn.	225.4	1000
WDAE,	Tampa, Fla.	273	1000
WDAF,	Kansas City, Mo.	365.6	1000
WDAG,	Amarillo, Texas	263	100
WDAH,	El Paso, Texas	267.7	50
WDAY,	Fargo, N. D.	261	50
WDBE,	Atlanta, Ga.	270	100
WDBJ,	Roanoke, Va.	229	50
WDBK,	Cleveland, Ohio	227	500
WDBO,	Winter Park, Fla.	210	500
WDBZ,	Kingston, N. Y.	232.1	10
WDEL,	Wilmington, Del.	266	100
WDGY,	Minneapolis, Minn.	263	500
WDOD,	Chattanooga, Tenn.	256	500
WDRC,	New Haven, Conn.	268	100
WDWF,	Edgewood, R.I.	440.9	500
WDWM,	Newark, N. J.	280.2	500
WDXL,	Detroit, Mich.	296.9	250
WDZ,	Tuscola, Ill.	278	100
WEAF,	New York, N. Y.	*491.5	5000
WEAI,	Ithaca, N. Y.	254	500
WEAM,	North Plainfield, N. J.	261	250
WEAN,	Providence, R. I.	367	500
WEAO,	Columbus, Ohio	*293.9	750
WEAR,	Cleveland, Ohio	*389.4	750
WEAU,	Sioux City, Iowa	275	100
WEBC,	Superior, Wis.	212	100
WEBH,	Chicago, Ill.	370.2	2000
WEBJ,	New York, N. Y.	272.6	500
WEBL,	New York, N. Y. (port.)	226	100
WFBQ,	Harrisburg, Ill.	*225.4	10
WEBR,	Buffalo, N. Y.	244	100
WEBW,	Beloit, Wis.	268	500
WEDC,	Chicago, Ill.	249.9	1000
WEEI,	Boston, Mass.	348.6	500
WEHS,	Evanston, Ill.	202.6	10
WEMC,	Berrien Springs, Mich.	515.6	4000
WENR,	Chicago, Ill.	*265.3	1000
WEPS,	Gloucester, Mass.	295	100
WEW,	St. Louis, Mo.	360	1000
WFAA,	Dallas, Texas	475.9	500
WFAM,	St. Cloud, Minn.	273	10
WFAV,	Lincoln, Nebr.	275	500
WFBC,	Knoxville, Tenn.	250	50
WFBE,	Cincinnati, O.	232.1	
WFBG,	Altoona, Pa.	*277.6	100
WFBJ,	Collegeville, Minn.	236	100
WFBL,	Syracuse, N. Y.	252	100
WFBM,	Indianapolis, Indiana	268	250
WFBR,	Baltimore, Md.	254	100
WFBZ,	Galesburg, Ill.	254	20
WFCI,	Pawtucket, R. I.	258.5	
WFDF,	Flint, Mich.	234	100
WFI,	Philadelphia, Pa.	394.5	500
WFKB,	Chicago, Ill.	217.3	500
WFKD,	Philadelphia, Pa.	249.9	10
WFLA,	Clearwater, Fla.	265.3	500
WFRL,	Brooklyn, N. Y.	329.5	100
WGAL,	Lancaster, Pa.	248	10
WGBB,	Freeport, N. Y.	244	100
WGBC,	Memphis, Tenn.	277.6	15
WGBF,	Evansville, Ind.	256	500
WGBI,	Scranton, Pa.	240	100
WGBR,	Marshfield, Wis.	228.9	15
WGBS,	Astoria, N. Y.	315.6	500
WGBU,	Fulford, Fla.	384.4	500
WGBX,	Orono, Me.	231.2	500
WGCP,	Newark, N. J.	252	500
WGES,	Oak Park, Ill.	313.6	500
WGHB,	Clearwater, Fla.	266	500
WGHP,	Mt. Clemens, Mich.	270	1500
WGM,	Jeannette, Pa.	269	150
WGMU,	Richmond Hill, N.Y. (port.)	236	100
WGN,	Elgin, Ill.	302.8	1000
WGR,	Buffalo, N. Y.	319	750
WGST,	Atlanta, Ga.	270	500
WGWB,	Milwaukee, Wis.	384.4	1000
WGY,	Schenectady, N. Y.	*379.5	50000
WHA,	Madison, Wis.	535.4	750
WHAD,	Milwaukee, Wis.	275	500
WHAM,	Rochester, N. Y.	278	100
WHAP,	New York, N. Y.	431	500
WHAR,	Atlantic City, N. J.	275	500
WHAS,	Louisville, Ky.	399.8	500
WHAZ,	Troy, N. Y.	379.5	500
WHB,	Kansas City, Mo.	365.6	500
WHBA,	Oil City, Pa.	250	10
WHBC,	Canton, Ohio	254	10
WHBD,	Bellefontaine, Ohio	222	100
WHBF,	Rock Island, Ill.	222	100
WHBG,	Harrisburg, Pa.	222	50
WHBL,	Chicago, Ill. (port.)	215.7	50
WHBM,	Chicago, Ill. (port.)	215.7	20
WHBN,	St. Petersburg, Fla.	238	10
WHBP,	Johnstown, Pa.	256	100
WHBQ,	Memphis, Tenn.	253	50
WHBR,	Cincinnati, O.	215.7	300
WHBU,	Anderson, Ind.	218.8	10
WHBW,	Philadelphia, Pa.	215.7	100
WHBY,	West De Pere, Wis.	250	50
WHDI,	Minneapolis, Minn.	278	500
WHEC,	Rochester, N. Y.	258	100
WHFC,	Chicago, Ill.	258.5	150
WHK,	Cleveland, Ohio	272.6	1000
WHN,	New York, N. Y.	361.2	5000
WHO,	Des Moines, Iowa	526	5000
WHOG,	Huntington, Ind.	241.8	15
WHT,	Deerfield, Ill.	399.8	3500
WIAD,	Philadelphia, Pa.	250	100
WIAS,	Burlington, Iowa	251	100
WIBA,	Madison, Wis.	236	100
WIBG,	Elkins Park, Pa.	222	50
WIBH,	New Bedford, Mass.	209.7	30
WIBI,	Flushing, N. Y.	218.8	50
WIBJ,	Chicago, Ill. (port.)	215.7	50
WIBM,	Chicago, Ill. (port.)	215.7	10
WIBO,	Chicago, Ill.	226	1000
WIBR,	Steubenville, Ohio	216	50
WIBS,	Elizabeth, N. J.	202.6	10
WIBU,	Poynette, Wis.	222	20
WIBW,	Logansport, Ind.	220	100
WIBX,	Utica, N. Y.	331.3	150
WIBZ,	Montgomery, Ala.	230.6	10
WICC,	Bridgeport, Conn.	285	
WIL,	St. Louis, Mo.	258	250
WILL,	Urbana-Champaign, Ill.	260	1000
WIOD,	Miami Beach, Fla.	247.8	1000
WIP,	Philadelphia, Pa.	508.2	500
WJAD,	Waco, Texas	*352.7	500
WJAG,	Norfolk, Nebr.	270	200
WJAK,	Kokomo, Ind.	254	50
WJAM,	Cedar Rapids, Iowa	268	100
WJAR,	Providence, R. I.	305.9	500
WJAS,	Pittsburgh, Pa.	275.1	500
WJAX,	Jacksonville, Fla.	336.9	1000
WJAZ,	Mount Prospect, Ill.	329.8	10000
WJBA,	Joliet, Ill.	206.8	50
WJBB,	St. Petersburg, Fla.	254	250
WJBC,	La Salle, Ill.	234	100
WJBI,	Red Bank, N. J.	218.8	250
WJBK,	Ypsilanti, Mich.	233	10
WJBL,	Decatur, Ill.	270	500
WJBO,	New Orleans, La.	268	100
WJBR,	Omro, Wis.	227.1	50
WJBT,	Chicago, Ill.	468.5	500
WJBU,	Lewisburg, Pa.	211.1	100
WJBV,	Woodhaven, N. Y.	469.9	100
WJBW,	New Orleans, La.	270	20
WJBY,	Gadsden, Ala.	260	90
WJBZ,	Chicago Heights, Ill.	419 3	100
WJJD,	Mooseheart, Ill.	*370.2	1000
WJR,	Pontiac, Mich.	516.9	5000
WJUG,	New York, N. Y.	516.9	250
WJZ,	Bound Brook, N. J.	*454.3	50000
WKAF,	Milwaukee, Wis.	261	1000
WKAQ,	San Juan, P. R.	*340.7	500
WKAR,	East Lansing, Mich.	285.5	1000
WKAV,	Laconia, N. H.	223.8	100
WKBA,	Chicago, Ill.	209.7	200
WKBB,	Joliet, Ill.	288.8	100
WKBC,	Birmingham, Ala.	225	50
WKBE,	Webster, Mass.	270.1	100
WKBF,	Indianapolis, Ind.	214	100
WKBG,	Chicago, Ill. (portable)	215.7	100
WKBH,	La Crosse, Wis.	249.9	500
WKBI,	Chicago, Ill.	220.4	500
WKBJ,	St. Petersburg, Fla.	280	250
WKBL,	Monroe, Mich.	252	15
WKBM,	Newburgh, N. Y.	285.5	100
WKBN,	Youngstown, Ohio	360	
WKBO,	Jersey City, N. J.	303.9	
WKBP,	Battle Creek, Mich.	265	
WKBQ,	New York, N. Y.	285	8
WKBR,	Auburn, N. Y.	225	100
WKBS,	Galesburg, Ill.	361.2	200
WKBT,	New Orleans, La.	252	50
WKBU,	New Castle, Pa. (port.)	238	50

(Continued on opposite page)

At the closing date of this magazine, the list of broadcast stations is subject to daily alterations, as regards wavelengths, power, etc. We especially request stations making changes at this time to send a notification to SCIENCE AND INVENTION in order that broadcast listeners may be advised as soon as possible of the new conditions which they may expect in tuning in the stations.

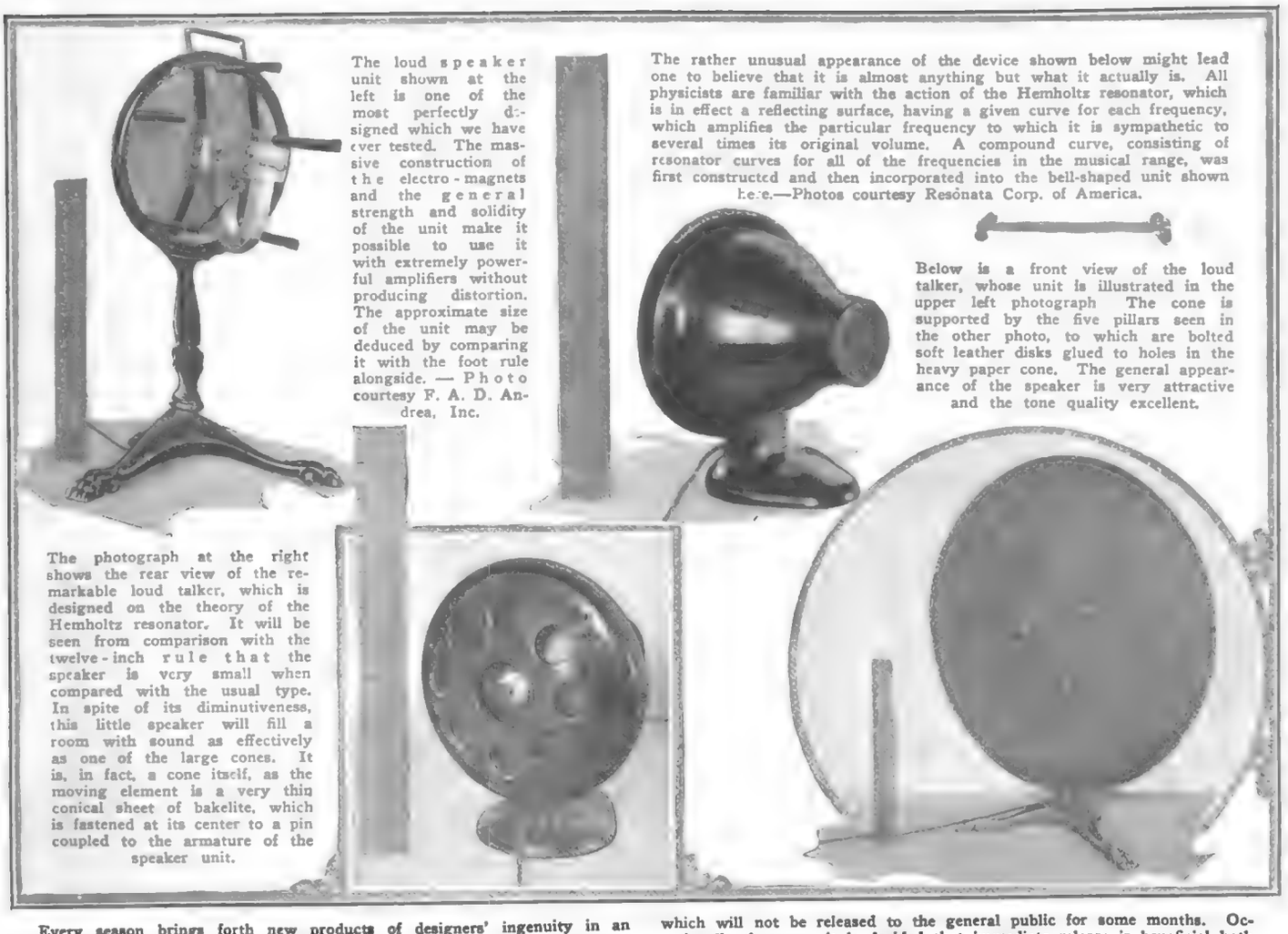
*Standard or constant frequency.
†Location of transmitter only.

LIST OF BROADCAST STATIONS IN THE UNITED STATES

Radio Call Letter	BROADCAST STA. Location	Wave (Meters)	Power (Watts)
WKBV,	Brookville, Ind.	236.1	150
WKBW,	Buffalo, N. Y.	362.5	1000
WKBX,	Harrisburg, Pa.		
WKBY,	Danville, Pa. (port.)	220	50
WKBZ,	Ludington, Mich.	256 3	15
WKDR,	!So. Kenosha, Wis.	428.3	
WKJC,	Lancaster, Pa.	258	50
WKRC,	Cincinnati, Ohio	325.9 & 422.3	1500
WKY,	Oklahoma City, Okla.	275	100
WLAC,	Nashville, Tenn.	235.4	1000
WLAL,	Tulsa, Okla.	250	100
WLAP,	Louisville, Ky.	275	20
WLB,	Minneapolis, Minn.	277.6	500
WLBA,	St. Petersburg, Fla.		
WLBC,	Muncie, Ind.	223.7	
WLBE,	Brooklyn, N. Y.	230.6	
WLBL,	!Stevens Point, Wis.	278	750
WLBF,	Kansas City, Mo.	211.1	25
WLBH,	Farmingdale, N. Y.	230	80
WLBI,	East Wenona, Ill.	296.9	250
WLCI,	Ithaca, N. Y.	266	50
WLIB,	!Elgin, Ill.	302.8	4000
WLIT,	Philadelphia, Pa.	394.5	500
WLS,	!Crete, Ill.	*344.6	5000
WLSI,	Edgewood, R. I.	440.9	500
WLTS,	Chicago, Ill.	258	100
WLW,	!Harrison, Ohio	*422.3	5000
WLWL,	New York, N. Y.	364.4	5000
WMAC,	Cazenovia, N. Y.	275	100
WMAF,	Dartmouth, Mass.	440.9	1000
WMAK,	Lockport, N. Y.	365	500
WMAL,	Washington, D. C.	293.9	500
WMAN,	Columbus, Ohio	266	50
WMAQ,	Chicago, Ill.	*447.5	1000
WMAY,	St. Louis, Mo.	248	100
WMAZ,	Macon, Ga.	261	500
WMBB,	Chicago, Ill.	250	500
WMBC,	Detroit, Mich.	256.4	100
WMBF,	Miami Beach, Fla.	381.4	500
WMBI,	Chicago, Ill.	288.3	500
WMC,	Memphis, Tenn.	499.7	500
WMCA,	!Hoboken, N. J.	340.7	500
WMRJ,	Jamaica, N. Y.	227.1	5
WMSG,	New York, N. Y.	302.8	500
WMVM,	Newark, N. J.	475.9	500
WNAB,	Boston, Mass.	280.2	100
WNAC,	Boston, Mass.	430.1	500
WNAD,	Norman, Okla.	254	500
WNAL,	Omaha, Nebr.	258	500
WNAT,	Philadelphia, Pa.	250	500
WNAX,	Yankton, S. Dak.	244	100
WNBH,	New Bedford, Mass.	248	250
WNJ,	Newark, N. J.	350	150
WNOX,	Knoxville, Tenn.	268	100
WNRC,	Greensboro, N. C.	223.7	10
WNYC,	New York, N. Y.	526	1000
WOAI,	San Antonio, Tex.	394.5	5000
WOAN,	Lawrenceburg, Tenn.	356.4	500
WOAX,	Trenton, N. J.	240	500
WOBB,	Chicago, Ill.	555.2	5
WOC,	Davenport, Iowa	*483.6	5000
WOCB,	Orlando, Fla.	293.7	50
WOCL,	Jamestown, N. Y.	275.2	15
WODA,	Paterson, N. J.	390.7	1000
WOI,	Ames, Iowa	*270.1	750
WOK,	!Homewood, Ill.	*217.3-238	20000
WOKO,	Peekskill, N. Y.	233	50
WOMT,	Manitowoc, Wis.	254.1	
WOO,	Philadelphia, Pa.	508.2	500
WOOD,	Fernwood, Mich.	242	1000
WOQ,	Kansas City, Mo.	278	1000
WOR,	Newark, N. J.	405.2	500
WORD,	Batavia, Ill.	275	5000
WOS,	Jefferson City, Mo.	440.9	500
WOW,	Omaha, Neb.	526	1000
WOWO,	Fort Wayne, Ind.	*227	500
WPAB,	Norfolk, Va.	319	100
WPAK,	Fargo, N. Dak.	275.1	50
WPAP,	Cliffside, N. J.	361.2	100
WPCC,	Chicago, Ill.	258	500
WPCH,	New York, N. Y.	273	500
WPDQ,	Buffalo, N. Y.	*205.4	50
WPEP,	Waukegan, Ill.	221.6	500
WPG,	Atlantic City, N. J.	299.8	5000
WPRC,	Harrisburg, Pa.	213.7	100
WPSC,	State College, Penna.	282.8	500
WQAA,	Parkesburg, Pa.	220	500
WQAE,	Springfield, Vt.	246	50
WQAM,	Miami, Fla.	285.5	750
WQAN,	Scranton, Pa.	250	100
WQAO,	!Cliffside, N. J.	361.2	100
WQJ,	Chicago, Ill.	447.5	500
WRAF,	Laporte, Ind.	244	100
WRAH,	Providence, R. I.	235	450
WRAK,	Escanaba, Mich.	256.3	100
WRAL,	Ithaca, N. Y.	365	25
WRAM,	Galesburg, Ill.	244	100
WRAV,	Yellow Springs, Ohio	263	100
WRAW,	Reading, Pa.	238	10
WRAX,	Philadelphia, Pa.	267.7	500
WRBC,	Valparaiso, Ind.	278	500
WRC,	Washington, D. C.	*468.5	1000
WRCO,	Raleigh, N. C.	252	100
WREA,	Shillington, Pa.	300	100
WREC,	!Whitehaven, Tenn.	254	10
WREO,	Lansing, Mich.	285.5	500
WRES,	Wollaston, Mass.	300	100
WRHF,	Washington, D. C.	256	50
WRHM,	Minneapolis, Minn.	242	50
WRK,	Hamilton, Ohio	270	100
WRM,	Urbana, Ill	273	500
WRMU,	Richmond Hill, N.Y. (port.)	256	100
WRNY,	!Coytesville, N. J.	373.8	500
WRR,	Dallas, Texas	246	500
WRRS,	Racine, Wis.	360	10
WRST,	Bay Shore, N. Y.	215.7	150
WRVA,	Richmond, Va.	256	1000
WSAI,	!Norwood, O.	325.9	5000
WSAJ,	Grove City, Pa.	229	250
WSAN,	Allentown, Pa.	229	100
WSAR,	Fall River, Mass.	322	100
WSAX,	Chicago, Ill. (port.)	268	100
WSAZ,	Pomeroy, Ohio	244	50
WSB,	Atlanta, Ga.	428.3	1000
WSBC,	Chicago, Ill.	288.3	1500
WSBF,	St. Louis, Mo.	273	250
WSBT,	South Bend, Ind.	315	500
WSDA,	New York, N. Y.	269	250
WSKC,	Bay City, Mich.	*260.7	100
WSM,	Nashville, Tenn.	282.8	1000
WSMB,	New Orleans, La.	319	500
WSMH,	Owosso, Mich.	240	20
WSMK,	Dayton, Ohio	275	500
WSOE,	Milwaukee, Wis.	248	500
WSRO,	Hamilton, Ohio	252	100
WSSH,	Boston, Mass.	261	100
WSUI,	Iowa City, Iowa	483.6	500
WSVS,	Buffalo, N. Y.	218.8	50
WSWS,	Batavia, Ill.	275.1	1000
WSYR,	Syracuse, N. Y.	352.7	500
WTAB,	Fall River, Mass.	266	100
WTAD,	Carthage, Ill.	236	50
WTAG,	Worcester, Mass.	545.1	500
WTAL,	Toledo, Ohio	252	100
WTAM,	Cleveland, Ohio	*389.4	3500
WTAQ,	Eau Claire, Wis.	254	1000
WTAR,	Norfolk, Va.	261	100
WTAW,	College Station, Texas	270	500
WTAX,	Streator, Ill.	231	50
WTAZ,	Lambertville, N. J.	261	15
WTHG,	Ferndale, Mich.	307	500
WTIC,	Hartford, Conn.	*475.9	500
WTRC,	New York, N. Y.	259.9	50
WWAE,	Electric Park, Ill.	384.4	10000
WWJ,	Detroit, Mich.	*352.7	1000
WWL,	New Orleans, La.	275	100
WWNC,	Asheville, N. C.	254	100
WWPR,	Detroit, Mich.	300	500
WWRL,	Woodside, N. Y.	258.5	100
WWVA,	Wheeling, W. Va.	318.5	150
2XAD,	Schenectady, N. Y.	22.6-26.2	1000
2XAF,	Schenectady, N. Y.	32.79	1000w

*Standard or constant frequency.
!Location of transmitter only.

New Loud Speakers of Merit



The loud speaker unit shown at the left is one of the most perfectly designed which we have ever tested. The massive construction of the electro-magnets and the general strength and solidity of the unit make it possible to use it with extremely powerful amplifiers without producing distortion. The approximate size of the unit may be deduced by comparing it with the foot rule alongside. — Photo courtesy F. A. D. Andrea, Inc.

The rather unusual appearance of the device shown below might lead one to believe that it is almost anything but what it actually is. All physicists are familiar with the action of the Hemholtz resonator, which is in effect a reflecting surface, having a given curve for each frequency, which amplifies the particular frequency to which it is sympathetic to several times its original volume. A compound curve, consisting of resonator curves for all of the frequencies in the musical range, was first constructed and then incorporated into the bell-shaped unit shown here.—Photos courtesy Resonata Corp. of America.

Below is a front view of the loud talker, whose unit is illustrated in the upper left photograph The cone is supported by the five pillars seen in the other photo, to which are bolted soft leather disks glued to holes in the heavy paper cone. The general appearance of the speaker is very attractive and the tone quality excellent.

The photograph at the right shows the rear view of the remarkable loud talker, which is designed on the theory of the Hemholtz resonator. It will be seen from comparison with the twelve-inch rule that the speaker is very small when compared with the usual type. In spite of its diminutiveness, this little speaker will fill a room with sound as effectively as one of the large cones. It is, in fact, a cone itself, as the moving element is a very thin conical sheet of bakelite, which is fastened at its center to a pin coupled to the armature of the speaker unit.

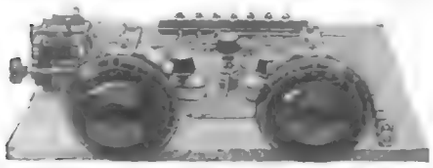
Every season brings forth new products of designers' ingenuity in an effort to produce the perfect loud speaker. All sorts of principles and theories are invoked in the usually vain attempts to create something new and effective. It is known that there are marvelous loud speakers already developed in the laboratories of a number of the large companies, which will not be released to the general public for some months. Occasionally, however, it is decided that immediate release is beneficial both to the manufacturer and the user, as in the case of the two speakers illustrated above. Both are very remarkable for the fidelity and beauty of their production. Names of makers on request.

The Duo-Regenerator

A Two-Tube Receiver of Ample Selectivity that Holds Forth Great Promise for DX Reception

By A. P. PECK, Assoc. I.R.E.

THOSE radio fans who live in and around New York City have a great many advantages over those living in outlying districts. One of the biggest of these is the accessibility to radio supplies. Today it is possible to buy almost anything

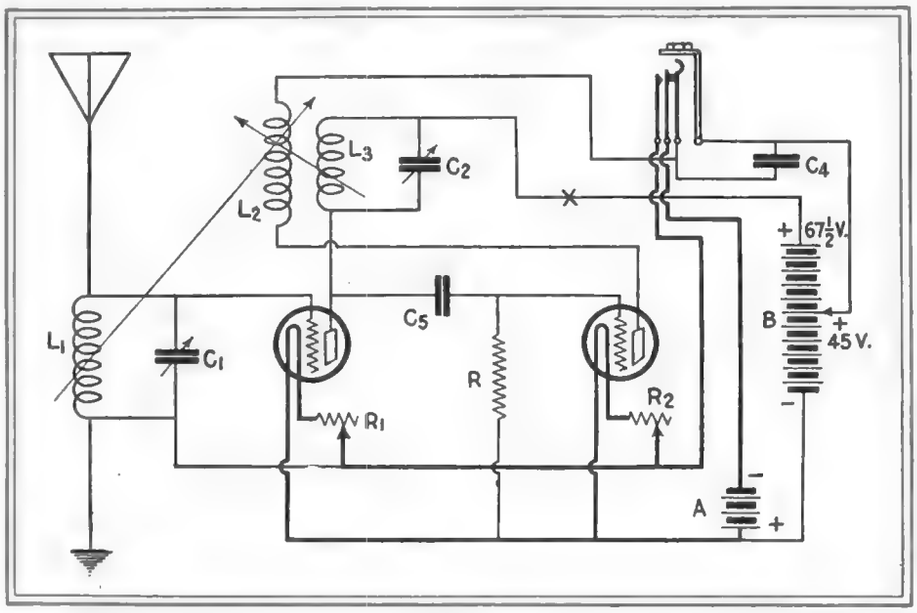


Front view of the duo-regenerative receiver.

in the radio line at cut rate prices in various New York stores. Apparatus that was very popular a year or two ago but has lost favor, not always because of inefficiency, can often be purchased for a mere song. One of the striking examples of this fact, is the three coil honeycomb mounting and coils that are designed to be used with it. It was not so long ago—probably a good many of our readers remember the time—when these three coil honeycomb mountings sold for prices ranging from $6.00 to $12.00. Today they can be purchased for anywhere from 75c. to $1.50. Although they are considered to be rather out of style, still the experimenter is not always one who cares particularly for style, and, therefore, he should by all means have at least one of these coil mountings and a set of the smaller sizes of honeycomb coils on hand for experimental purposes.

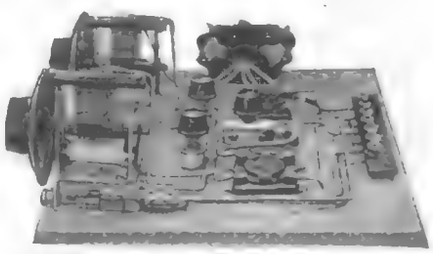
With honeycomb coils and a suitable mounting innumerable circuits can be tried out and experimented with. Coil values can be quickly changed until the best results are obtained. A circuit using such an arrangement is always as flexible as can be desired.

It was while playing around with one of these three coil mountings and a bunch of honeycomb coils that the writer struck upon the circuit which is shown in the diagram given here. While this arrangement of apparatus may seem quite new to the average fan, still no distinct originality is claimed. Double regeneration circuits of this type are quite well known in England and other foreign countries, but they have never been developed to any great extent in the United States. The reason for this is not quite clear, as some double regenerative circuits are quite efficient. This one is particularly so, and the only fault that the writer had to find with it is that it is somewhat cranky. However, once the operator gets the knack of tuning it no trouble will be experienced, and it is possible to cut through local interference and pull in the DX with surprising regularity, when it is considered that only two tubes are employed. Of course, a two-stage audio frequency amplifier could be added to this set, making a regular, four tube B.C.L. receiver out of it. Then, loudspeaker volume would be combined with DX results. However, the average DX devotee usually likes to wear phones, and so to lapse into comparative seclusion. This is true with the writer, and therefore, the circuit is shown only with the two essential vacuum tubes.



The circuit at first may appear rather unorthodox, but it utilizes a principle known and used for years. It affords high selectivity with exceptional signal strength.

We do not recommend any reader to assemble this set on a nice panel and expend a lot of pains on the construction of it at first. If he does he will probably be disappointed, because with a nice looking layout, if the set does not seem to operate at its best immediately, he is disgusted with the job. If on the other hand, a bread-board lay-out such as shown in the photos, is



The bread-board type of mounting is used.

employed at the start, the operator is usually willing to play around with it until he really knows something about it. Then he can concentrate on learning to tune it, and need not worry about appearances. After this stage of development has been gone through, if the builder likes the set well enough, he can build it up in a neat fashion. If not, he can tear it apart and try some other circuit. There will be no hard feelings regardless of which process is followed. As to the receiver itself, it will be seen by reference to the diagram, that the plate circuit of the detector tube is fed back to the grid circuit of the radio frequency amplifier, as well as to its own grid circuit. The theory underlying the operation of such a receiver will probably be somewhat complicated, and so we will not enter into it here. However, it works. What more can be asked for?

The values of the various parts used are as follows—we are considering for the moment that the builder will desire to use honeycomb coils:

Coils L1 and L3 are each 50 turn honeycomb coils.

Coil L2 is a 75 turn coil.

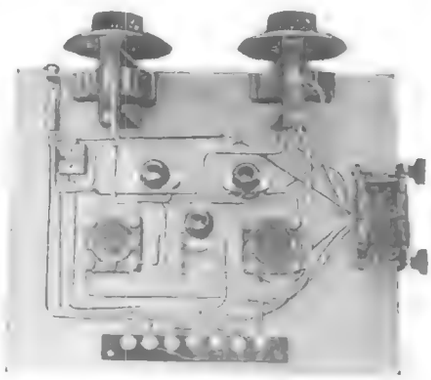
Condensers C1 and C2 have a capacity of .0005-mf.

Condenser C3 is the usual grid condenser of .00025-mf. capacity.

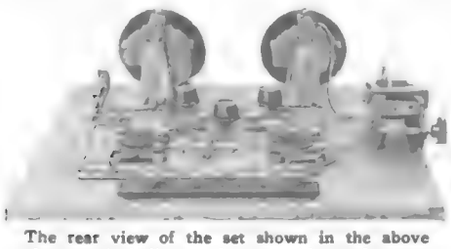
R is a grid leak.

R1 and R2 are standard rheostats.

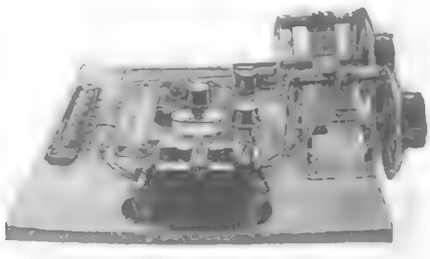
(*Continued on page* 947)



A top view of the duo-regenerator reveals the simplicity of the set. The layout is well arranged.



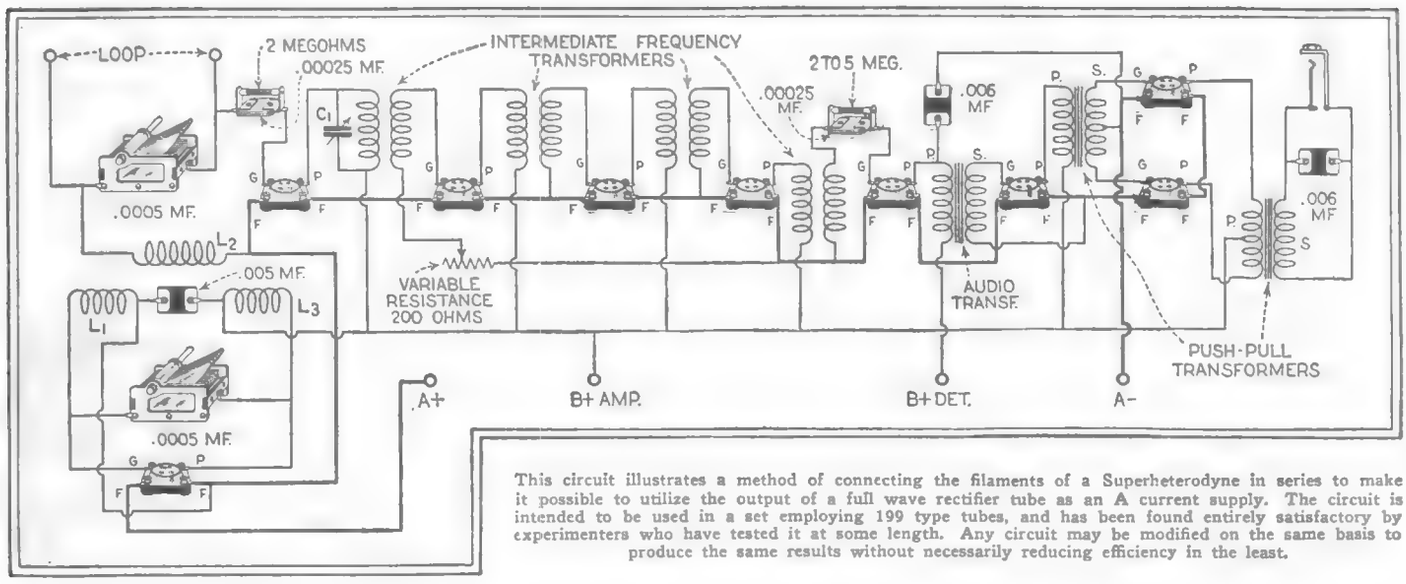
The rear view of the set shown in the above photograph indicates the assembly to be very simple, with the leads run more for efficiency than appearance. Note the binding-post strip.



The three coil honey-comb coil mounting is seen in the foreground. The best type has a vernier adjustment which permits very accurate control of coupling.

RADIO ORACLE

In this department we publish questions and answers which we feel are of interest to the novice and amateur. Letters addressed to this department cannot be answered free. A charge of 50c. is made for all questions where a personal answer is desired.



This circuit illustrates a method of connecting the filaments of a Superheterodyne in series to make it possible to utilize the output of a full wave rectifier tube as an A current supply. The circuit is intended to be used in a set employing 199 type tubes, and has been found entirely satisfactory by experimenters who have tested it at some length. Any circuit may be modified on the same basis to produce the same results without necessarily reducing efficiency in the least.

COMPLETE BATTERY ELIMINATION

(523) Q. 1. A. P. Slocum, Los Angeles, California, writes for information as to the possibiilty of completely eliminating batteries by using a full wave rectifier tube to supply filament and plate current for a complicated circuit such as a superheterodyne.

A. 1. The complete elimination of all batteries in a multi-tube circuit amounts to quite a problem. It is a comparatively simple matter where a large current may be drawn for the "A" battery supply, but where only AC is available it is quite difficult to rectify a sufficient amount of current to operate the tubes in a standard circuit. It is quite a different matter to supply the "B" battery current by rectifying the line AC by using a full wave rectifier tube, as a comparatively small amount of current is required. The output of the largest of the full wave rectifier tubes is limited to about 80 milliamperes, while nine 201-A tubes would require 2.25 amperes for filament supply. This amounts to 2250 milliamperes, so it may be seen that the standard arrangement of filaments is entirely out of the question. Even if 199 type tubes were used throughout the filament current would amount to 540 milliamperes. There is a way to get around this disadvantage which is well known to radio engineers. This method involves connecting the filament of the tubes in series rather than parallel. If nine 199 type tubes are connected in parallel, the filament supply must be .540 amperes at three volts. If the tubes are connected in series, the current drops to .06 amperes while the voltage must be increased to 27 volts. With the circuit arrangement such as shown in the diagram in this page it is necessary to vary the usual procedure somewhat in connecting the grid returns of the various tubes, as every point on the filament current is at a different potential relative to every other point. This is also an advantage in a way due to the fact that almost any desired C battery or grid potential may be obtained at will by moving the grid return about to various positions. The circuit illustrated at the top of this page is that of a standard superheterodyne circuit which has been modified by placing the filaments at the various tubes in series rather than in parallel. The various inductances L1, L2, L3 are left to the discretion of the experimenter, but any of the standard oscillatory transformers may be used with this circuit. It is recommended that the intermediate frequency transformers be adjusted so that the peak is at some given frequency, preferably in the neighborhood of 30 kilo-cycles. C1 in the diagram is a condenser which is used to tune the first transformer sharply to the selected intermediate frequency, although it is preferred by some designers to tune the output of the last transformer instead of the input of the first. The audio frequency amplifier is of the type commonly known as a push-pull circuit, where two tubes are connected in parallel cross separate windings of the same transformers to amplify both halves of the output of the detector tube. An output transformer is not necessary with this type of amplifier to protect the loud speaker from excessive current surges, as no battery is used in the secondary circuit of the last transformer. It will be noticed that one 200-ohm variable resistance controls oscillation.

AUDIO FREQUENCY AMPLIFICATION

(524) Q. 1. Francis Bushman, Las Palmas, Cal., asks our opinion as to the relative efficiency of the various methods of amplifying at audio frequencies.

A. 1. For a number of years, the only type of audio frequency amplification in common use employed transformer coupling, which made high voltage amplification possible at the expense of considerable distortion. Transformers were gradually improved by careful design and painstaking research, until it can be said that there are two or three makes of transformers which will not noticeably distort signals falling within the normal voice frequency range. Resistance coupled amplification later came into vogue, with the immediate result that the quality of reproduction was immensely improved. A similar system of impedance coupled amplification has been developed, which, like the resistance coupled amplifier, does not produce as high an amplification as an equal number of transformer coupled stages, but does insure almost perfect reproduction. The expense of operation is less with this type, and we feel inclined to recommend it highly.

PORTABLE SUPERHETERODYNES

(525) Q. 1. Henry P. Hammer, Franklin, Pa., asks our advice on the construction of a portable superheterodyne receiver.

A. 1. Speaking in a general way, we think it is the wrong idea to attempt building a superheterodyne in too small a space. While we do not believe in building a set so large as to be awkward in appearance, a 7" or 10" by 29" panel is not in our estimation objectionably large. Most console cabinets of modern design will accommodate such a set.

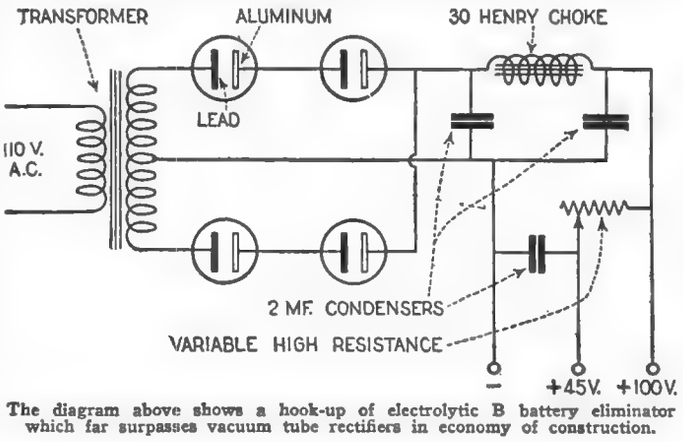
It would seem from our experience that it is best to select the intermediate frequency transformers from those designed for use with 201 type tubes, as these will also work very well with the 199 type. There is a greater plate current passing in the case of the 201 tubes, and with transformers designed for the smaller tubes there might be some danger of burning out the windings. If we were building the Madison-Moore Superheterodyne which you have in mind, we would certainly build it according to the design recommended for the 201 tube layout with regard to the spacing between the coils, etc. It will also work satisfactorily with the coils spaced closer as you specify, in the case of the Madison-Moore set, thanks to the metal shield surrounding each coil.

The question you raise concerning the use of 201 tubes as compared to 199 tubes is rather like splitting hairs, in the opinion of many experts. It seems when all is said and done that the 201 type tubes afford greater range of reception and considerably greater volume of signals. The next best arrangement requires six 199 tubes, with two 201 tubes in the two stage audio amplifier. Next in order of efficiency, is the line-up using all 199 tubes. The small tubes undoubtedly do give very clear reception, and it is hard to say in any particular case and with a given set of tubes just which arrangement affords the greater advantage. These vary considerably and so do some sets, even though they are built from the same parts. You will find out more about these matters concerning your proposed superheterodyne after operating it for a week or so and trying different tubes, than you will by reading half a dozen textbooks. In the early days of radio we were very much impressed by the suggestions given by various writers on superheterodyne operation, but we have since found that many of the suggestions given were theoretical and, to our minds, practically worthless.

In regard to the best variable condensers to use, we have found that the new straight-line-tuning designs are very fine and are generally superior to straight-line-frequency, straight-line-capacity, or straight-line-wavelength types. We use one highly efficient make for all experimental work in our laboratory, but for obvious reasons it is not wise to publish the name of one manufacturer in a field as large as this. The new straight-line-tuning design incorporates the good features of each of the other three types, at the same time reducing their disadvantages to practically zero.

You can very easily change the wavelength of both the loop and the oscillator with any given set of variable condensers by connecting a small mica variable condenser of about .0005 mf. capacity, in series with each variable condenser. This will reduce the wavelength in the event that the minimum is too high with the original arrangement.

This department has made it a policy not to mention the trade names of parts except in cases where confusion might result from such names not being used. We will be glad, however, to recommend a list of parts for your set if you write us, after noting the rules at the head of this page.



The diagram above shows a hook-up of electrolytic B battery eliminator which far surpasses vacuum tube rectifiers in economy of construction.

ELECTROLYTIC B ELIMINATOR

(526) Q. 1. Jack Nagel, Toronto, Canada, asks for information concerning the use of lead-aluminum electrolytic rectifier cells in a B battery eliminator circuit.

A. 1. The circuit given at the left is one which caused much favorable comment when it was first published in the May, 1925 issue of this publication. It is, in effect, a full wave rectifier circuit which does away with the necessity of using expensive rectifier tubes and their accessories.

Four of the lead-aluminum rectifier cells, familiar to all radio hams as used in transmitting circuits, are employed in this eliminator to avoid the use of any special type of tube rectifier. The transformer is the largest item of expense.

Scientific Humor

EXPERIENCE IS SOMETIMES THE MOTHER OF INVENTION, TOO!

DING: "What is Freewriter doing since that golddigger won her breach of promise suit against him?"

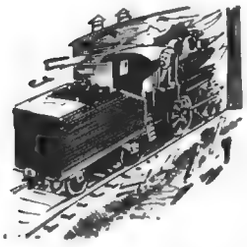
DONG: "Trying to invent an emergency brake for fountain pens!"—*Mrs. F. L. Cosby.*

A LEAF OUT OF ADAM'S & EVE'S EXPERIENCE

PROFESSOR: "Can you give me an example of a commercial appliance used in ancient times?"

STUDENT: "Yes, sir; the loose-leaf system used in the Garden of Eden."—*Clifton Ask.*

"PROFICIENCY"



Mike had been told to run the switch engine into the round house. He had run it in three times and each time thrown it into reverse and run it back out again. "Mike" said the superintendent, "I thought you said you could run an engine."

"And so I kin," answered Mike. "I had the danged thing in there three times and you wouldn't shut the door on it."—*G. N. Alworth.*

YOU CAN'T BLAME HIM

BIOLOGY PROF.: "Didn't you study this last chapter on the nervous system?"

STUDENT: "Sir, I read a page and then it said that the brain should never be forced to work when already tired, and so I followed the rule."—*B. Arnolfo.*

USE YOUR TICKET

CONDUCTOR: "You've given me a paper drinking cup instead of your ticket."

PASSENGER: "I know it. Punch a hole in the bottom of it, will you? I want to get a drink without spilling water down my neck."—*Paul S. Powers.*

NO TIN LIZZIE THERE!

HE: "Would you believe it, in the whole block where I live there isn't a soul who own a flivver?"

SHE (innocently enough): "Uncanny neighborhood, eh?"—*E. A. Hogan.*

First Prize $3.00

YOU OUGHT TO SEE WHAT THE CABIN-ET

RAY D.O.: "Did you ever go to a Radio Banquet?"

LOWDE SPEAKER: 'No what did they serve?'

RAY D.O.: 'Oh they had Spagetti *à la* bus bar. Pretsel coils. Buttered Bakelite Sandwiches. The meat was 3 Circuit Jack Rabbits and the Rheostats were the *Pièce de Resistance.*"—*Leslie Carpenter.*

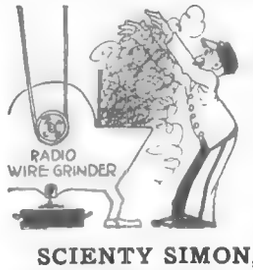
WE receive daily from one to two hundred contributions to this department. Of these only one or two are available. We desire to publish only scientific humor and all contributions should be original if possible. Do not copy jokes from old books or other publications as they have little or no chance here. By scientific humor we mean only such jokes as contain something of a scientific nature. Note our prize winners. Write each joke on a separate sheet and sign your name and address to it. Write only on one side of sheet. We cannot return unaccepted jokes. Please do not enclose return postage.

All jokes published here are paid for at the rate of one dollar each, besides the first prize of three dollars for the best joke submitted each month. In the event that two people send in the same joke so as to tie for the prize, then the sum of three dollars in cash will be paid to each one.

NO PUZZLE HERE

WANTED: A seven-letter word for "The Yanks are coming!"

ANSWER: Dentist.—Louise Krauss.



DESIRE

The man next door has heard of radio "ground" wires, and would like to know how they grind them.—*Les I'an Every.*

REVOLTING REVOLUTION?

BOLSHO: "Do you know that this earth which we inhabit is becoming more anarchistic day by day?"

VISM: "How come?"

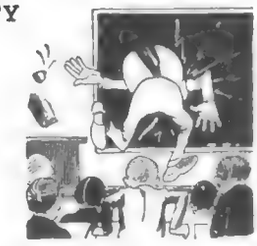
BOLSHO: "Yes, sir, this earth completes one revolution every 24 hours.—*Henry Fischer.*

ISN'T ICE MADE OF SOFT WATER?

FIRST: "I heard your old man died of hard drink."

SECOND: "Yes, poor fellow, a cake of ice fell on his head."—*Earl Floathe.*

PERMEABILITY



MATH. TEACHER (*explaining* problem). "Now watch the board closely and I'll run through it again." — *Steve Bugar.*

GIVE ME A PUFF

"I just bought a brand new oxy-hydrogen blow pipe today," said the first boy.

"Bring it out here I've got some tobacco."—*Burl Knutson.*

HOUSEHOLD HINTS

Never throw away old doughnuts, they make good napkin rings.

A moth ball dissolved in pancake batter will keep the pancakes from rusting.

Dandruff may be removed easily by rubbing the scalp with an old horse-radish grater.

A coat of shellac on the bottom of a cherry pie, will keep the juice from leaking out.

Never open soft boiled eggs with a can opener.—*Richard Buchanan.*

BALDNESS CURED

LAST HOPE: "My barber is the first man who has discovered a remedy that will raise hair on any bald head."

HOPEFUL: "Oh, I am not so sure about that. My barber can tell some hair-raising stories, too."—*Peter P. Udre.*

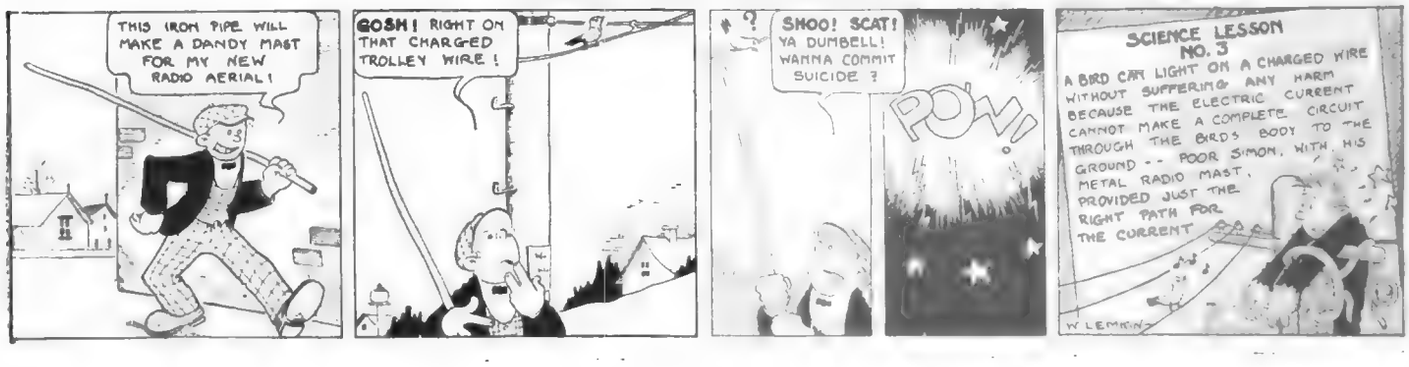
DISCREPANCY SOMEWHERE

"I don't see how a watch can keep accurate time."

"Why not?"

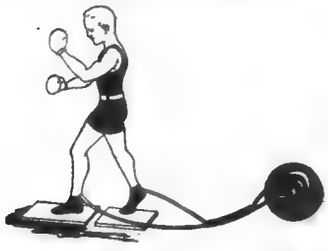
"Well, time flies, but a watch only runs."—*Carl C. Slaybough.*

SCIENTY SIMON, SCIENTIST!


THIS IRON PIPE WILL MAKE A DANDY MAST FOR MY NEW RADIO AERIAL!
GOSH! RIGHT ON THAT CHARGED TROLLEY WIRE!
SHOO! SCAT! YA DUMBELL! WANNA COMMIT SUICIDE?
POW!
SCIENCE LESSON NO. 3
A BIRD CAN LIGHT ON A CHARGED WIRE WITHOUT SUFFERING ANY HARM BECAUSE THE ELECTRIC CURRENT CANNOT MAKE A COMPLETE CIRCUIT THROUGH THE BIRDS BODY TO THE GROUND -- POOR SIMON, WITH HIS METAL RADIO MAST, PROVIDED JUST THE RIGHT PATH FOR THE CURRENT
W. LEMKIN

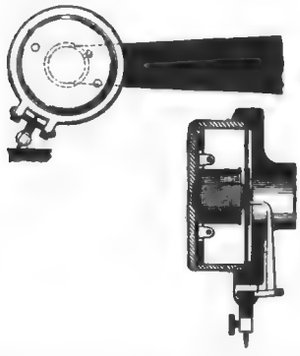
LATEST PATENTS

BOXING DOLL



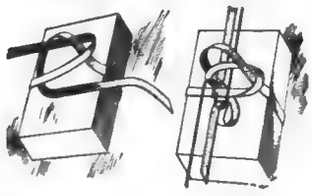
No. 1,605,738, issued to Wataru Idemote, Sacramento, California. A real novelty in toys, which consists of a doll representing a boxer the arms of which are actuated by means of compressed air. The arms are pivoted and connected to bellows within the body of the doll, each arm being separately adjusted to imitate the actions of a boxer. The toy is worked by pressing a rubber bulb containing two compartments, separately compressible, each of which controls one of the bellows within the mechanism.

ELECTRICAL PICK-UP



No. 1,604,655, issued to C. H. Millward. One of the several recently developed inventions for electrically operated phonographs. A diaphragm, suspended in the field of an electromagnet, is mechanically coupled to the phonograph needle-holder and is caused to move in sympathy with the motions of the needle. The motion of the diaphragm causes small currents to be set up which may be easily amplified.

TYING BOW-KNOTS



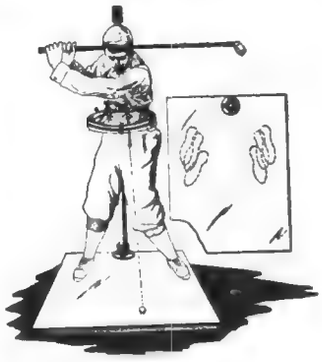
No. 1,598,309, issued to Thomas A. Quinlan. This invention relates to a method of mechanically tying knots in package binding cords, which makes it possible to quickly tie a neat, efficient knot which may be easily untied. Two wire hooks are used, each adjusting one of the loops after the binding material has been looped as shown at the left above.

MOUNTING DIAPHRAGMS

No. 1,604,788, issued to H. J. Round. In a telephone receiver or transmitter, an aperiodic diaphragm is usually supported within the field of an electromagnet. In many cases extraneous sounds are introduced by the vibration and reflection of sound between the diaphragm and the inner walls of its suporting case. This may be remedied by dampening the diaphragm with soft or pulverulent material as shown.

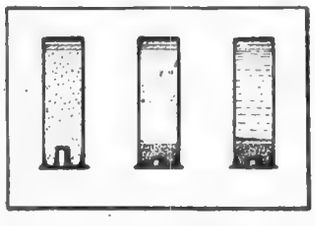
GOLF INSTRUCTOR

No. 1,604,118, issued to W. J. Glancey. Designed particularly for the dub golfer who cannot keep his eye on the ball, this apparatus should find a great usefulness as an aid to the professional instructor. The would-be golfer is encircled by a steel belt which prevents him from bending or assuming incorrect positions, while his head is retained in the correct position by means of a small skull cap fastened to a stand something like the highly unpopular photographer's head-clamp for unruly subjects.

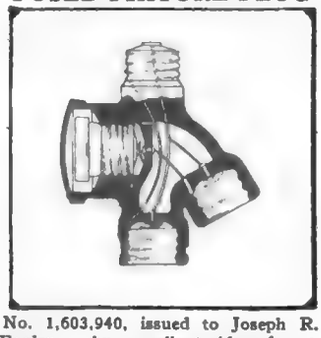


GAS-LIBERATING CARTRIDGE

No. 1,600,223, issued to B. C. Goss. A clever means for producing tear gas and other disabling gases and projecting them with some force in any desired direction. An ordinary rifle or shot gun shell is filled with a mixture of powder and a gas-generating chemical or liquid, and the firing of the shell causes the gas to be liberated and projected with excellent effect.



FUSED FIXTURE PLUG

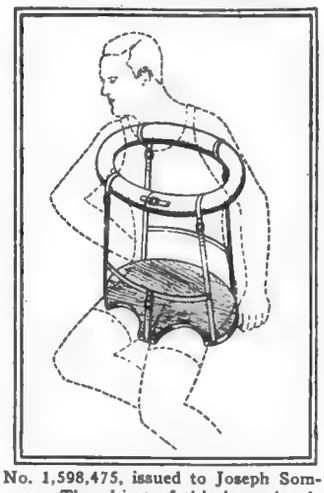


No. 1,603,940, issued to Joseph R. Eaglen. An excellent idea for a plug to be used in connection with a household electrical appliance of any kind which draws a rather heavy load from the line. A fuse is in series with one of the sockets.

BOOKMARK

No. 1,601,832, issued to G. L. Jackson. A small clip made of celluloid or metal which may be slipped over the edge of a page in a book to mark the exact line desired. It does not extend beyond the edge of the page, therefore cannot be broken off or twisted with resultant injury to itself or the book.

BATHING CHAIR



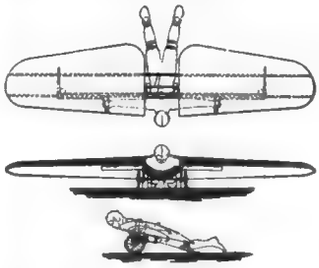
No. 1,598,475, issued to Joseph Sommar. The object of this invention is to provide a bathing chair in which a bather may assume a comfortable seated position in the water, and will be buoyed up and maintained with his head above the water at all times. With this device, it is possible for the novice to remain in the water indefinitely without receiving a dangerous submersion.

ANTENNA CONNECTOR

No. 1,606,268, issued to Arthur Smith. This device consists of a double shell of copper of the general shape shown, one-half of which fits closely within the edges of the other. A bolt is inserted through a hole in the center of the device to retain the halves in proximity. As shown in the lower drawing, the lead-in wire is inserted into the lower opening and wrapped once or twice around the bolt. The antenna wire is then slipped thrugh the other two channels as shown, after which the two halves are fitted together and the nut is tightened on the retaining bolt.

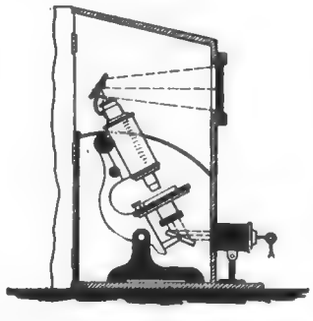
AIRPLANE GLIDER

No. 1,600,838, issued to Ray M. Moore. Intended as a means of instructing a pilot in the control of wing surfaces, this glider is intended to be towed along three or four feet above the ground while the pilot experiments.

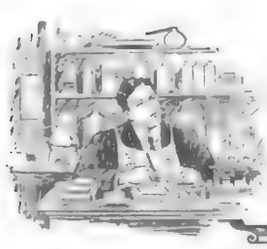


PROJECTING MICROSCOPE IMAGES

No. 1,601,864, issued to Paul H. R. Leroux. An apparatus which permits of rendering visible to several persons the projections obtained from a microscope image by throwing the image reflected from an obliquely placed mirror upon a ground glass screen.



NOTICE TO READERS. The above illustrated and described devices have recently been issued patent protection but are not as yet to our knowledge available on the market. We regret to advise that it is impossible to supply the names and addresses of inventors of the above devices to any of our readers. The only records available, and they are at the Patent Office at Washington, D. C., give only the addresses of the inventors at the time of application for a patent. Many months have elapsed since that time, and those records are necessarily inaccurate. Therefore, kindly do not request such information. —EDITOR.



THE ORACLE

The "Oracle" is for the sole benefit of all scientific students. Questions will be answered here for the benefit of all but only matter of sufficient interest will be published. Rules under which questions will be answered:

1. Only three questions can be submitted to be answered.
2. Only one side of sheet to be written on; matter must be typewritten or else written in ink; no penciled matter considered.
3. Sketches, diagrams, etc., must be on separate sheets. Questions addressed to this department cannot be answered by mail free of charge.
4. If a quick answer is desired by mail, a nominal charge of 50 cents is made for each question. If the questions entail considerable research work or intricate calculations, a special rate will be charged. Correspondents will be informed as to the fee before such questions are answered.

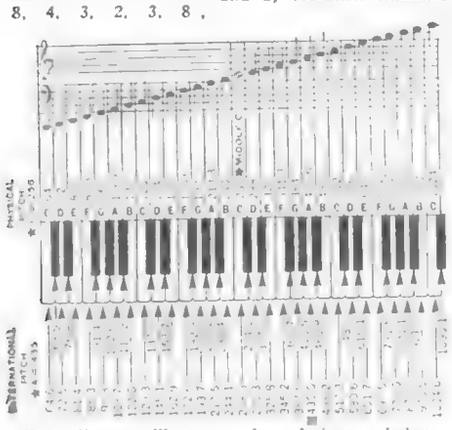
THE MUSICAL SCALE

(2154) Q. 1. Miss Cecelia Brown, Greenland, Pa., would like an explanation of the musical scale adopted for modern music.

A. 1. Music gives pleasure because of its agreeable combinations of sounds. These pleasant combinations are not matters of chance but depend upon certain simple relations which can be numerically expressed that exist between the vibration numbers of the musical notes. The simplest possible relation is 1:2, and this is the ratio that exists between the vibration numbers of the first and eighth notes of the musical scale, the eighth note, upper C (do) or between corresponding notes of adjacent octaves. The whole eight notes are called the diatonic scale.

A simple ratio such as 3:2, 4:3, 5:4, 9:8, etc., exists between tones on the scale and the keynote. The eight tones are given names and numbers and are graphically represented by definite positions on the musical staff, which consists of five parallel lines with the sign of the clef at the left.

The key of D has d^1 for its keynote with a vibration number of 288. If this number is multiplied by the "ratio of vibrations," $\frac{9}{8}, \frac{5}{4}, \frac{4}{3}, \frac{3}{2}, \frac{5}{3}, \frac{15}{8}$, and 2, vibration numbers



This diagram illustrates the relations existing between the frequencies of vibration, the keyboard positions and the positions of the notes on the musical staff. There are a number of standard pitches used for different purposes, but the two shown here convey the idea.

for the seven other tones in the scale of this key are found. Tabulating the results:

	c^1	d^1	e^1	f^1	g^1	a^1	b^1	c^{11}	d^{11}
Key of C	256	288	320	351.3	384	426.6	480	512	576
Key of D		288	324	360	384	432	480	540	576

It will be noted that there is a close agreement of the vibration number of the corresponding notes in the two keys, except those for f^1 and c^{11}. To remedy this and in order to have the intervals in the key of D about the same as those in the key of C, musicians introduce two new semitones, f^1 sharp and c^{12} sharp, when playing the key of D.

The vibration number of a *sharp* is $\frac{25}{24}$ of the vibration number of the note from which it is derived. In constructing the scale for other keys, some notes have to be flatted. The vibration number of a *flat* is $\frac{24}{25}$ of the frequency of the note from which it is derived. Five of these semitones are needed in the construction of the scales for the different keys.

The chromatic scale in any octave consists of the eight regular tones of the diatonic scale and five semitones. The white keys on a piano are for the eight regular tones in the key of C, while the black keys serve for the semitones (sharps and flats).

In constructing the chromatic scale, slight variations between the frequencies of corresponding notes, such as e^1 and a^1 in the keys of C and D, are not remedied. To correct all the differences arising in the building of the several keys would give about 70 notes to an octave. This is an impossible number for usable keyboards.

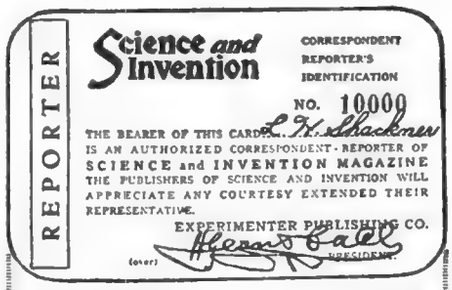
To get regular intervals between the tones of the scale whatever may be the key, the even-tempered scale has been devised. It consists of 13 tones with equal intervals between. Each note, then, is a semitone. Since there are 12 intervals and since the vibration number of the octave is twice that of its keynote

$$\sqrt[12]{\frac{2}{1}} \text{ or } \sqrt[12]{2}$$

will be the ratio number of the semitone interval.

$\sqrt[12]{2}$ is approximately 1.06. The vibration number of each tone is found by multiplying the frequency of the preceding tone by 1.06. The even-tempered scale is the scale used with most musical instruments.

It is unfortunate that there are several standards for pitch. The standard tuning fork of physical laboratories is the middle C (c^1) with 256 vibrations per second. This gives a^1 a frequency of 427. The standard for International Pitch, however, is a^1 with a frequency of 435. The American Federation of Musicians have adopted still another standard, 440 for a^1. There is still another for Concert Pitch, which is rapidly going out of use.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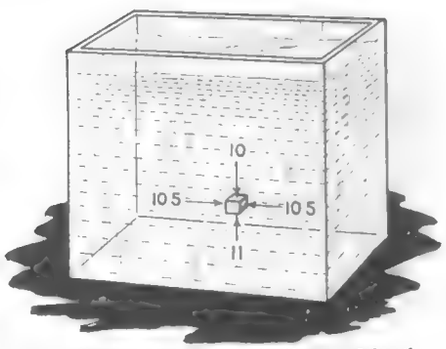
Submitted manuscripts cannot be returned unless accompanied by postage.

BUOYANCY

(2155) Q. 1. Mrs. S. T. Fairbanks, Butte, Montana, requests an explanation of why it is that some objects are buoyed up in liquids.

A. 1. In order to assist in explaining why objects are buoyed up by the water, let us imagine a cube measuring 1 centimeter on each edge submerged beneath the water so that the top is 10 centimeters from the surface (see figure). The pressure on each of the four sides will be 10.5 grams, since the average depth of a side is 10.5 centimeters. The pressures on the sides exactly counterbalance each other, and the object is not moved either to right or left. The pressure is 10 grams on the top and 11 grams on the bottom. These two do not balance each other. The pressure upward is greater by 1 gram than the pressure downward. Plainly, such an object as we have supposed, if its own weight amounted to nothing, would be pushed up to the surface. If it weighed more than a gram its weight would overcome the upward push and it would descend to the bottom.

If an object weighs less than the water it displaces, it will float or, if submerged, will rise to the surface. It will not rest with its top even with the surface of the water, but it will project far enough above the surface so that the submerged part will displace an amount of water the weight of which is equal to its own weight. For example, if the 1-centimeter cube weighed 0.5 gram, it would rise until only one half of it was under water, and it would therefore displace 0.5 gram of water. An iron pail will float on the water because, though it is made out of very heavy material, it is so shaped that it displaces a great deal of water. The iron ship floats for the same reason. The vessel therefore sinks in the water only deep enough to displace an amount of water equal to its own weight.

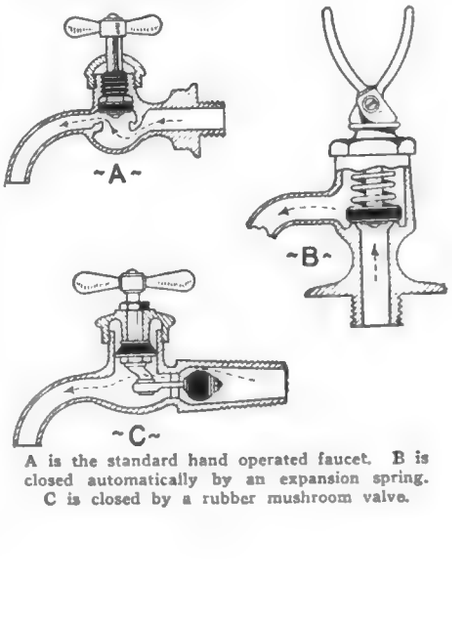


The principle of buoyancy is illustrated by the action of water pressure on this cube.

WATER FAUCETS

(2156) Q. 1. William J. Ashley, Bronx, N. Y., requests information concerning the various types of water controlling faucets and spigots which are in common use.

A. 1. In the drawing above are illustrated three types of faucets which represent those most commonly found in the average home and office. A is the standard type which is closed by turning a handle in a clockwise direction, thus forcing a leather or fiber washer to seat in an opening in such a way as to prevent the water from reaching the outlet tube. Another type, illustrated at B, is opened by squeezing two handles toward one another, thus raising the valve from its seat and permitting the flow of water. This is accomplished by a scissors-like action, and the automatic closing of the valve is attended to by the expansive power of the compressed spring when the handles are released. The third type, C, is closed by a rubber mushroom valve and an obviously simple mechanism.



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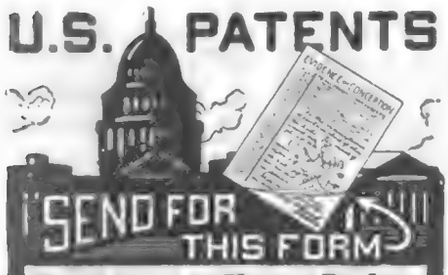

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Edited By
Joseph H. Kraus

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INVENTIONS WANTED

(989) Geo. Thatcher, Phillipsburgh, N. J., asks for a list of inventions wanted.

A. There are a great many new inventions wanted, but only a few concerns actually make requests for ideas which would suit their needs.

The best thing to do is to find out what you would like to have and what your friends would like to have and then on the strength of this develop your ideas.

You must remember that when someone makes a request for an invention there are hundreds of individuals who will work upon the system, but the most money is made by a revolutionary idea which is invariably discovered by the inventor himself. The air-brake, the telephone, the sewing machine, radio, the vacuum tube and many other inventions are of this type.

AUTOMOBILE LIGHT DIMMER

(990) Q. 1. N. H. Silverman, Lorain, Ohio, submits a diagram of a switch for dimming the headlights of an automobile which consists merely of a suitable resistance and a push button which short circuits the resistance. This switch is to be placed on the steering wheel of an automobile so that the driver can easily reach and hold it and so that when the switch is pressed, current to the headlights of the automobile will be forced to pass through the resistance, thus dimming the headlights. He asks whether he could possibly secure a patent on this system.

A. 1. A good patent attorney can always secure a patent for you on a technicality. We are of the opinion that a patent on a headlight dimmer as described by you would have to be secured on such a technicality because the system is very old to us. We do not advocate your applying for a patent on this method, although we will admit that there is a probable market for the device if you are in a position to market it yourself. Several other similar methods have been advocated and you will find that some automobile dealers advertise a headlight dimmer which is just an ordinary push button and which can be strapped fast to the steering wheel or any other part of the car desired. One of the best dimmers now found is the Barkelew which is operated from a foot control and will either dim the lights or brighten them at the will of the operator.

COMBINATION SWITCH AND RHEOSTAT

(991) Q. 1. Louis Goldberg, Philadelphia, Penna., submits an idea for a radio rheostat which has a switch included so that when the knob is pushed in, the contact arm on the knob will be forced away from the wire of the rheostat, thus breaking the circuit. He claims for this device that no more connections will be necessitated than those already on the rheostat. He also wants to know whether he can sell the idea to someone who will take out the patent in his own name.

A. 1. We do not believe a radio rheostat with a switch included is a new idea and are of the opinion that the same has been patented before. Moreover modern rheostats have an off position at the extreme end. If you had a six-tube set and six rheostats controlled each of the tubes, it would be necessary that you push in the knobs of each and every rheostat before you could turn out the filaments. With one single switch the work could be accomplished by one movement.

No one else can get a patent out under their own name if the idea is yours, unless they perjure themselves and by so doing are naturally liable to jail sentences. However, another individual can take out a patent in your name and assign it to himself if he will defray the cost of the patent and also meet with any other contract arrangements which you may make with that said individual.

BROADCASTING STATION

(992) Q. 1. Charles Hallbeck, New York, City, asks what we think of his idea to erect a broadcasting station which will announce day and night the time as though a radio announcer were doing it. The system is to be entirely automatic.

A. 1. As an unusual broadcasting stunt, the time signal station would undoubtedly be quite popular. It would have to have a certain wavelength and would have to be on the air all the time, yet operators would have to be in constant attendance so that the station could be turned off in event of SOS signals.

We doubt that you could ever make this idea practical and we do not see how anyone can possibly continue to finance a time signal station because it would be impossible to receive any advertising programs on this station, and listeners would only tune in for one minute at a time. We do not advise going any further with the idea.

PHONOGRAPH SOUND CONTROL

(993) Q. 1. J. E. Kitchim, Vancouver, B. C., Canada, has a device consisting of three claws which he attaches to the diaphragm casing of a phonograph and by screwing a set screw firmly over the pin of the phonograph, he is able to control the volume of that phonograph. He requests our opinion on the device.

A. 1. Your system for dampening the volume as produced by the diaphragm of a phonograph is not new nor is it practical. At the present time the phonograph is on the wane and we do not believe that it will ever become extremely popular again. We consequently do not advocate patenting any phonograph attachment or appliance, unless it will be of such a revolutionary character that it will increase the interest in the phonograph.

AVIATION FIELD ILLUMINATION

(994) Q. 1. S. Milton, Bressington, Altoona, Penna., has submitted a searchlight for flying fields which is semi-indirect in nature and which, due to a peculiar cone arrangement, is supposed to spread the light across the field. He requests our advice.

A. 1. The only kind of lights to use for flying fields are searchlights which may be directed down the field or which will illuminate the field indirectly. A space must be left clear for the pilot to land. We believe that your particular contrivance would not be very suitable for a flying field due to the standard. The indirect lighting which you illustrate is not new nor is the method of distributing the light over the field very new. We doubt that a patent on the same can be secured.

(*Continued on page* 938)

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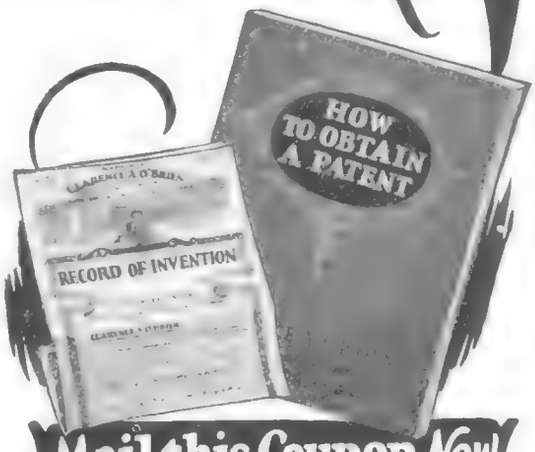

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Patent Advice

(*Continued from page 936*)

HELICOPTER

(995) Q. 1. H. Hoenstein, New York City, submits a drawing of a helicopter with propellers mounted on each of the wings which also serve to raise the machine. He requests the advisability of patenting the system.

A. 1. While helicopters are very practical on paper, the instant that one begins to use them, they become impractical. Even models work much better than the finished machines. The difficulty of helicopters is the inability to control them and in event of shutting off of power, it is relatively impossible to bring the mechanisms back to earth safely. Perhaps the new airplane parachute will aid in accomplishing this work. We do not advocate applying for a patent on your suggestion, unless you are in a position to build a working model of the device.

CAMLESS ENGINE

(996) Q. 1. Ernest O. Reuter, Philadelphia, Penna., asks whether we know of any patent on a four cycle camless engine.

A. 1. A four cycle camless engine and crankshaftless engine has been placed upon the market recently. This device received very much publicity in the local newspapers. Not knowing what your particular system is like, we are not in a position to advocate applying for a patent on your suggestion.

FLOWER POT

(997) Q. 1. Sinclair Abey, Stratford, Ont., Canada, submits a drawing of a separable flower pot made of paper and so arranged that it can be split to facilitate handling the lump of soil surrounding the roots of a plant and transplanting said plant. He asks our advice for patenting this system.

A. 1. While your flower pot possesses some merit, we believe that the idea is entirely too costly to permit of its extensive use and, therefore, do not advocate applying for a patent on the same. This flower pot if made of paper will not have to be separable as indicated in your drawings; the paper itself can easily be torn off and the cake of soil can easily be transplanted.

Many modern systems employ newspaper flower pots which are planted in the ground, no attention being paid to the paper cup. This in time disintegrates as soon as the roots of the plants are big enough to penetrate through the paper.

CAPLESS FOUNTAIN PEN

(998) Q. 1. Fred Pearlman, Asheville, N. C., asks our opinion on a capless fountain pen in which the nib of the pen slides back into the barrel and a hinged cap swings forward over the top of the pen, closing the opening.

A. 1. While your capless fountain pen possesses advantages, it also possesses many disadvantages. Your statement to the effect that this is a capless pen is not literally true. You have a cap, the only difference being that this cap is not removed from the pen. The sliding of the entire ink bag and the barrel back and forth in the pen is a very objectionable feature because slight pressure on the ink bag due to this sliding motion would tend to collapse the same and force the ink out of the pen. We do not advocate applying for a patent on the suggestion because we do not believe that you will find a market for the same.

WINDOW WIPER

(999) Q. 1. R. M. Elliott, Hammond, Ind., submits a diagram for a window wiper which consists of a motor-driven pair of tongs which push a rubber wiper up and down the entire length of a street car window. He requests advice as to the advisability of patenting this system.

A. 1. We believe that the device is entirely too expensive to be practical and unless the system operated in guides, uneven pressure on the glass would result. Vision with this type of wiper is continually being obscured by the moving tongs. We do not advocate applying for a patent on the suggestion unless you are absolutely sure of securing a market on the same which marketability we doubt.

KETTLE

(1000) Q. 1. N. Busse, Buffalo, N. Y., submits a sketch of a kettle with a compartment in the bottom which is intended to retain heat. He claims that such a kettle will cause the water to boil therein much more quickly than if there were no heat chamber.

A. 1. Your suggestion for a kettle with a compartment intended to retain heat is new. While it is true that this particular heat chamber allows the gas flame to enter up toward the top of the kettle, heating the water on the top and sides as well, it also follows that the capacity of the kettle is decreased. Consequently, the same quantity of water will not boil in a shorter time. There is no particular advantage to be gained by your system and we do not even believe that you can secure a patent on the same.

PATENTS

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Into the Fourth Dimension

By RAY CUMMINGS

(*Continued from page* 901)

It came to the end of the line. Other workers appeared; carried it away—a long flexible rod of newly created thought-matter. The basic inorganic substance of this world. The thickness of a man's body, it seemed coming of interminable length. Then the first worker gave out—dropped back exhausted. Then others. The rod grew tenuous and pale in places. It broke. Workers carried away the broken segments. It was not a solid yet; they moulded it by their touch as they carried it away.

Another signal from the leader. The two hundred workmen, their duty done for the time, rose and departed. They moved unsteadily, exhausted. And another shift came to take their places.

How long a spell of mental work this might have been, I cannot say. Bee asked me, in an awed whisper, how long we had been watching. A futile question! As Will once said, "Like trying to add an apple to an orange." To me—idly watching, and with memory of an Earth-standard of what we are pleased to call Time—I would have said, five minutes. To one of those laboring workers—an eternity of effort. Yet in our fatuous little world of Earth we tick off seconds, minutes, hours, and think we are establishing a standard for the Universe!

Brutar said, "That is the crude thought-material. From there it goes to our workshops, where other minds bring it to higher, individual substances from which we make—well, we make these things we are making here."

His look of cunning came again. He would give away no secrets to me—his enemy. He seemed very proud of his cunning, this Brutar. A man of low intelligence, I realized. Yet he must be powerful, to be the leader of all this. Later I learned that he had a powerful mind—not for creating this useful substance of industry; nor was his an intellect of keen reasoning ability. Rather was it a mind powerful for the weaving of that tenuous thought-substance of combat. He was a warrior. And in mental speech as well, he was fluent, plausible, guileful.

Bee was saying, "Is all work mental?"

He did not understand the question. Eo said, "she means, is all work done by the mind?"

"Oh yes," Brutar smiled. "Why not? Except—well you've seen what part the hands play—the bodies. It is comparatively unimportant."

Articles In February "Radio News"

Can We Radio the Planets? By Hugo Gernsback
Radio Photography and Television, By E. F. W. Alexanderson
The RADIO NEWS Batteryless Receiver, By McMurdo Silver
The Universal Pilotone Receiver
A Three-Foot Roll-Type Speaker
The Haynes DX-2 Multivalve Receiver
Constructing the Aero-Dyne Receiver
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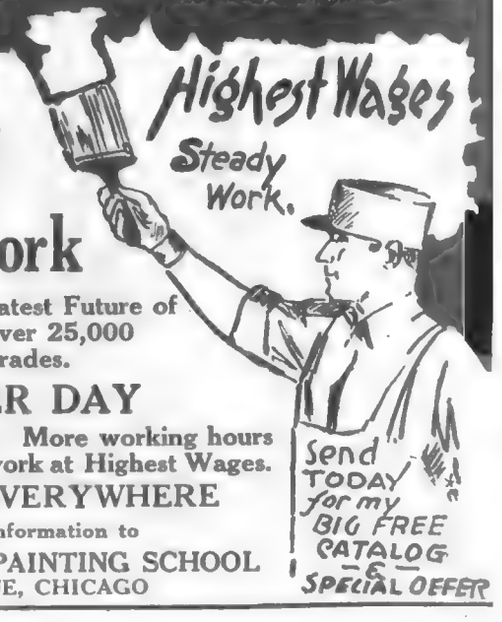

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"May we see what they are doing with that thought-substance?" I suggested.

"No," he smiled. "I told you before, not now."

I did not press it. I was wondering if the shell of this huge globe would let me through. Could I clutch Bee and will myself away into the void? Could I not thus escape Brutar. . .

My thoughts must have reached him. He said sharply, "If you regard the welfare of your mind, Rob, you will not attempt to wander." His tone changed to a menacing contempt. "I can strike that sickly mind of yours from your body in an instant. Have a care!"

Brutar, still talking to me, bent to show me one of the lolos plants. It shrank away from him as though in fear. He frowned; struck it a blow with his hand. His attention momentarily was diverted from us. I heard Eo murmur softly, yet tensely.

I fancied I caught a warning glance from Eo. Bee gave a low half-suppressed cry of fear. I smiled at Brutar.

"You are too suspicious," I said. "If we are to be friends you go about it badly."

He did not answer that, and I added, "You said you would tell us how you discovered our Earth-realm. It must have seemed an extraordinary discovery."

His vanity was easily touched. He smiled again.

"Yes, I will tell you. And show you. It is no secret—that leader Thone of the Big-City knows it. . . So I do not mind showing you."

CHAPTER XIII

THE LOLOS FLOWER

WE stepped back from the wall. Brutar led us onward through the twilight. We passed globes translucent with light from within; heard the hum and hiss of work going on—but Brutar would not let us enter. We passed a dark bowl of enormous size, like a great globe cut in half. We encircled its rim. I stared down into darkness; grey shapes of inert things were ranged there—things which had been manufactured of the thought-substance, I surmised. But Brutar would not say.

We skirted the misty lake. It seemed a blanket of fog lying there. Within me, at the sight, a vague pang stirred. A desire—unpleasant in its suggestion of a needed gratification; and with it a premonition of coming pleasure.

I was puzzled. There was no instinct to guide me; or if there was, my puzzled reason subverted it. I described my feeling to Eo.

"It seems physical," I said. "I had for-

gotten my body—but there seems a pang there."

"Thirst," he said readily. The word he used, gave me the thought of thirst. And this was water, or its equivalent.

I knelt beside the white layers of mist. Did I inhale it, or drink it? I have no means of knowing; but I know that the pang left me, and that the experience was vaguely pleasant.

We moved on. Came at last to the great field. Behind us the opposite side of the encampment—the enclosure wherein I had seen the creation of thought-material—was now almost over our heads. The ground of the field was soft and flaky—it seemed as though it might have been a black soil lying in flakes. Things were rooted within it—growing things set in long orderly rows that stretched up the concave surface into the dimness of distance. They appeared to be plants; in height about to my knee. A central stalk; branches bent outward like gesturing arms. A bud, or flower, at the top. It seemed to carry features—a face. My imagination? Something that had been said or suggested to me? Possibly. But the things bent aside as we advanced upon them. They seemed eyeing us; suddenly I was conscious of a myriad eyes from everywhere fixed upon me.

I said to Brutar, "This black ground—is that thought-material?"

"Yes," he said. "Made from the same substance you saw created. But many mental processes were necessary to bring it to this final state."

"And then you planted these—things in it?" I asked. "They look as though they had an intelligence. I don't understand that. Are they growing here—or what?"

Brutar hesitated. I think that the man's learning was not very great. Eo said:

"I believe I can explain it, Rob. All things in our world are divided into two classes. One—the inert, material bodies. These we create from nothingness to their final perfected state. The other class—living organisms—is very different. The addition of a Divine-thought is necessary. These plants—to be specific—are called *lolos*. The lolos plant. To create it we must have a spore—an infinitesimal something already existing. Of Divine—or shall I say—supernatural origin."

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"Supernatural," Brutar put in. "There is nothing Divine."

Eo did not heed him, but went on earnestly, "With this spore, others like it may be created by our own mentalities. And nurtured by our mentalities through a period of growth. But that latter process can be simplified by the production of this soil in which the plants are then nourished. It is basically an identical process."

(*Continued on page* 945)

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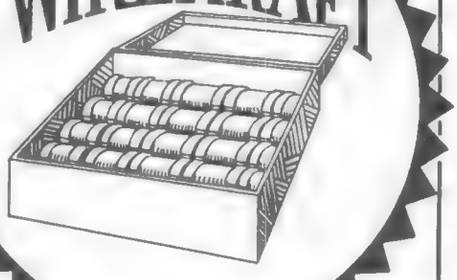

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(*Continued from page* 910)

and then, proceeding diagonally down the page to the lower right-hand corner, we come across a candle-stick, a carrier, a very clever push-pin or picture hanger and a bath brush. At the bottom of the page, in the center, we locate a wire storage battery carrier.

We can thus see that different contestants in different parts of the world have already sensed the possibilities of the Wirekraft Contest and are already busy sending in their models in an effort to win one of the sixteen prizes, which will be awarded monthly, for the next fiscal year.

Perhaps the suggestions outlined will give other Wirekrafters an idea as to what is acceptable in this contest. The technique is simple, and the tools required are relatively few and will be found enumerated at the end of this article. For those desirous of learning how to build Wirekraft models, we would suggest that they write to this department of this publication for a reprint containing the method of procedure. Some practical hints on the construction of wire novelties are contained in the original article, which may be had for the asking.

At the end of this article, the rules of the Wirekraft Contest are given. The value of the prizes is also shown and it is quite evident from the fact that sixteen prizes are to be awarded monthly that the average Wirekrafter stands a good chance of winning one of the awards. We can already foresee a wonderful future for this contest.

We would, therefore, suggest that all those who care to enter the Wirekraft Contest get busy at building their models right away. Remember that when the contest is young, there are never as many entries as after the contest has been running for a few months. It follows that much better articles will progressively win the first prize.

Rules of Wirekraft Contest

THIS is a wirekraft contest. Hence wire is to be used in the construction of all of the models entered in this contest.

The size of the wire to be employed is limited. The heaviest wire must not be larger than No. 8 American or B and S gauge, and the smallest no smaller than No. 30 B and S gauge—or (for foreign countries not having these exact sizes), the nearest available equivalent.

No. 8 B and S gauge is .12849 inches in diameter or 3.264 millimeters. Its nearest equivalent in the Birmingham or Stubs iron wire gauge is No. 18. In the Stubs steel wire gauge it is No. 30; in the British Imperial Standard it is No. 10. The nearest wire to No. 30 B and S gauge which is .01002 inches or .2546 millimeters in diameter is No. 31 in the Birmingham or Stubs iron wire gauge. In the Stubs steel wire gauge it is No. 80; in the British Standard it is No. 33.

The builder may avail himself of the opportunity of using any intermediate sizes of wires between No. 8 and No. 30, B and S gauge.

The wire may be copper, brass, iron, steel, or these materials coppered, tinned, nickel-plated, or galvanized, or the wire may consist of an alloy. Any kind of wire available on the market may be employed.

It is preferable to use non-rusting wires. The publishers will not be responsible for the rusting of any model. To protect wire which rusts easily or for color effects, the models may be painted, lacquered, varnished or otherwise covered.

Any additional decorations or accessories may be employed to enhance the effect. (Example: Silk on a lamp shade; glass in decorative fixtures; electric motors for operating mechanisms, etc.)

Only those portions actually constructed of wire will be judged.

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(Example: A reed basket is suspended from a wire chain. The basket not being made of wire is NOT considered. On the merits of the chain only will the prize be awarded.)

Wires may be twisted, spliced, soldered, welded or bound together. Wire may be used to bind other wires together. If soldered a non-corrosive soldering flux should be employed.

There is no limit to the size of the models which may be entered nor to the number of entries which any maker may submit during any calendar month.

In every case the model must be forwarded express prepaid to SCIENCE AND INVENTION Magazine. It should be tagged with name and address of the maker, who will prepay charges if model is to be returned.

The first prize will always be awarded to a model possessing the greatest utilitarian merits. This must be an object NOT found on the market today.

The second prize will always be awarded to an object possessing the best decorative artistic or constructive effect. It may be a replica of an existing object or a model of an imaginative object or effect.

The remaining prizes will be judged from either one or the other viewpoints at the discretion of the judges.

All models may remain at the office of this publication until the close of the contest at the descretion of the editors.

This contest starts January 1st, 1927, and will terminate January 1st, 1928.

This is a monthly contest lasting for twelve months, each monthly contest closing on the first of the month following dates of issue. Thus the contest for the month of February, 1927, will close March 1st, 1927. Winners for February will be announced in the May Issue.

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Tools Required

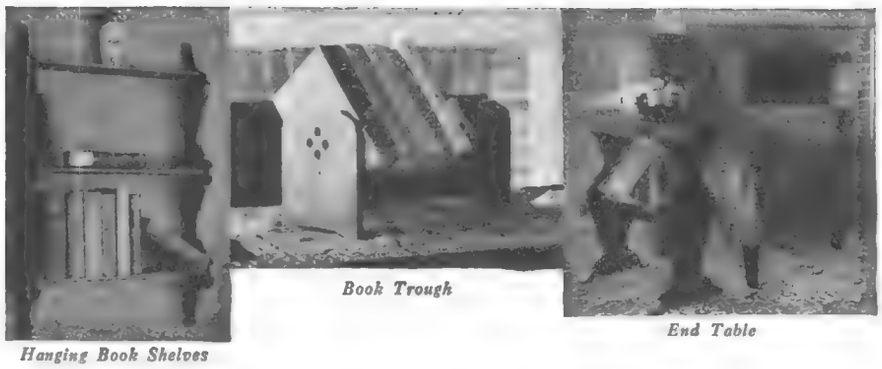
THE tools required for the construction of Wirekraft articles may be found in the Dec. issue of this publication, a reprint of which will be sent free upon request. The following tools may be used advantageously:

1 pair flat-nosed pliers. 1 pair round-nosed pliers. 1 wire cutter. 1 hacksaw. 1 small vise. 1 soldering iron.

The materials which are necessary are:

Solder, soldering paste or flux, nails, one piece of wood, and most important of all, wire of the sizes specified in the contest rules and regulations.

If the builder decided to weld his wires together, a small welding transformer or a storage battery may be used for this purpose. For the formation of long cylinders, a coil winding machine or a lathe may be advantageously employed. Toy motors for the operation of any devices constructed of wire could of course be procured and added to the model and the addition of miniature sockets and bulbs to illuminate the interior of any buildings constructed of wire might also find a place in some of the constructions.



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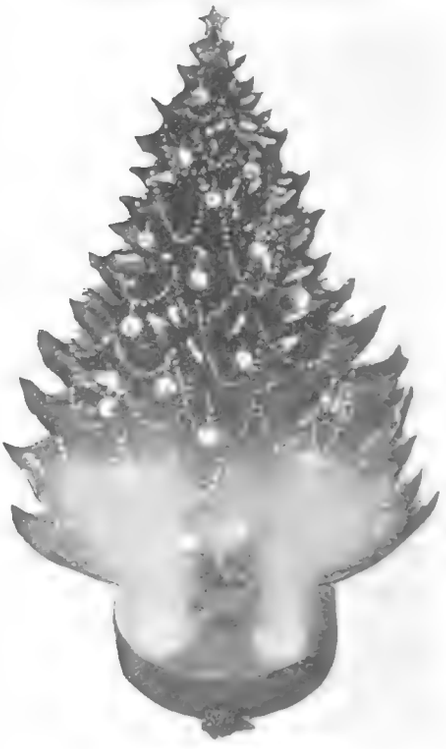
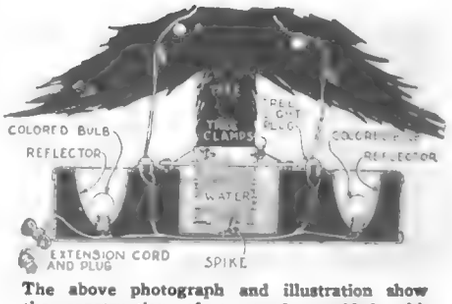
LIGHTED TREE STAND





The above photograph and illustration show the construction of a stand provided with bulbs at the bottom for illuminating the decorations on the tree. A cross-sectional diagram illustrates how the tree is clamped in place and shows the well containing water for nourishing the tree, making it last longer.— Photo Courtesy All-American Radio Co.

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Into the Fourth Dimension

(*Continued from page* 941)

"It is much like our own world," I said. "Except that these plants seem to have a conscious mind."

"Why not?" Brutar demanded. "Every living thing has a mind."

Eo added, "Since the essence of everything is mentality—naturally the spark of life must bring that mentality to consciousness."

"These things then," I said, "they know that they are alive?"

"Of course. And Rob, what you told Brutar of your Earth-agriculture—what you called your vegetable kingdom—seems not so very different from ours."

"But it is different," I said. "Our plants—our growing things—are not aware that they are alive."

Eo demanded gently, "How do you know that? Is it not perhaps that your own mentality is lacking, to gauge the power of theirs?"

I smiled. "It may be so. . . Brutar, these lolos plants—what is their purpose?"

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"With them we are going to your Earth," he said. "This lolos plant of itself has a power very wonderful. We crush it; and the blood of it taken into our body, sends the mind upon strange and pleasant wanderings."

"Evil wanderings," said Eo.

A drug! as Brutar further explained, I realized it. And I wondered if this lolos plant—the name of it—sounded thus since to my own mentality it suggested the lotus flower. I think that was so.

The blood of this plant was a powerful narcotic. Brutar had been addicted to its use; and his wandering mind had come into the Borderland. He had seen our Earth-realm; gone further until he experienced the sensations of our physical consciousness. Had come back, to gather his followers; to create in quantity the blood of this lolos that all might go to conquer and enjoy this greater realm.

Brutar was absorbed in his subject. Listening to him, I had nevertheless noticed that Bee's attention was fixed upon Eo. She was whispering to him. With his sweet, boyish face, he was listening to her, enraptured. He was close beside her, and I saw that he was touching her. Brutar, still talking to me, bent to show me one of the lolos plants. It shrank away from him as though in fear. He frowned; struck it a blow with his hand. His attention momentarily was diverted from us. I heard Eo murmur softly, yet tensely.

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"You are right—girl. This is evil—I realize it now. . . Rob! Hold yourself firm! Stay with me! We will try to escape. . ."

* * * * * *

I MUST revert now to Will, Thone and Ahla in the Big-City. They had felt Bee's thoughts; they knew we were in danger; Ahla had caught just enough to know that we were with Brutar.

"We must go," Thone hastily declared. "Try and follow them, Ahla. . . That Brutar is a mind very powerful for evil."

With Will held firmly between them, they swept out into Space. To Will it was a dream, a nightmare of mental chaos. Rushing through the dark—through seemingly endless Space for endless Time. But he saw none of the distorted things that I had seen, for he was in friendly hands. A rushing black Nothingness sweeping past. A vague dream of flight; but presently he found his mind clearing.

The void was illimitable. But soon it seemed not wholly empty. To one side was a faint glow—an infinite distance away, as though it might have been a nebula gleaming over Space a thousand million Light-years of distance. Or something shining from another Time—eons away. It moved sidewise as they swept along. It glowed, faded, was gone.

They reached Will. Bee gasped, "He—he is hurt! Oh! Will—it's you! Help him—his mind struggles to leave us! He is wounded. I think—I think he is going to die!"

"A universe off there?" He asked Thone.

"We will not go there." Ahla murmured. She seemed to shudder. "That is the Realm of Disease. I hope never to go there."

Endless Time passing. Or perhaps, as Will was thinking, Time was in abeyance, standing still, non-existent.

And Will saw other far-off gleaming patches, like faint drifting star-dust. Soon they were gone. He did not ask what they might be.

Ahla still felt Bee's thoughts. Then they ceased. Will became aware of a confusion; a fluttering; as though now the flight had lost direction. He gazed around intently, searchingly, but the space at that moment was wholly empty.

"Where are we?" he asked.

Thone and Ahla were exchanging thoughts. Thone said:

"Where are we? There is no answer, Will. There is nothing here. We are nowhere."

A confusion. It seemed that Ahla and Thone felt that Brutar's self-created world might be found by approaching the Realm of Disease. Will waited, listening silently while they talked of it. . .

Abruptly Will saw something. A blur—a vague spot of luminosity beneath them. It was moving. Suddenly he knew it was not large and far-away, but small and very close. It mounted; broke visually apart, resolved itself into two dark blobs. Shapes. The moving shapes of a man and a woman.

They came nearer. The woman was Bee! It was Bee and the youthful Eo. He was clinging to her; she seemed helping him struggle upward.

They reached Will. Bee gasped, "He—he is hurt! Oh Will—it's you! Help him—his mind struggles to leave us! He is wounded. I think—I think he is going to die!"

She seemed crying as she flung herself into Will's arms. "I don't want him to die. He is my friend—so gentle, so lovable—I don't want him to die!"

END OF PART 6

The Duo-Regenerator

By A. P. PECK

(*Continued from page* 930)

C4 is a condenser of from .001- to .002-mf. capacity.

J is a single circuit, filament control jack.

The most satisfactory arrangement of the coils will usually be found by placing L2 in the center of the mounting and L1 and L3 on either side. Then complete control of the coupling can be had. Probably the best way to get this set into action and study its tuning qualities, will be to loosen the coupling between L1 and L2 as far as possible. Couple L3 to L2 until the detector circuit oscillates. Tune for a carrier wave, varying condensers C1 and C2 simultaneously, and keeping them both at about the same value. Even though the detector circuit is oscillating, the set will not radiate to any appreciable extent because of loose coupling. After a station is picked up and tuned in to maximum signal strength and the coupling between L2 and L3 has been loosened for clearness, start to tighten the coupling between L1 and L2.

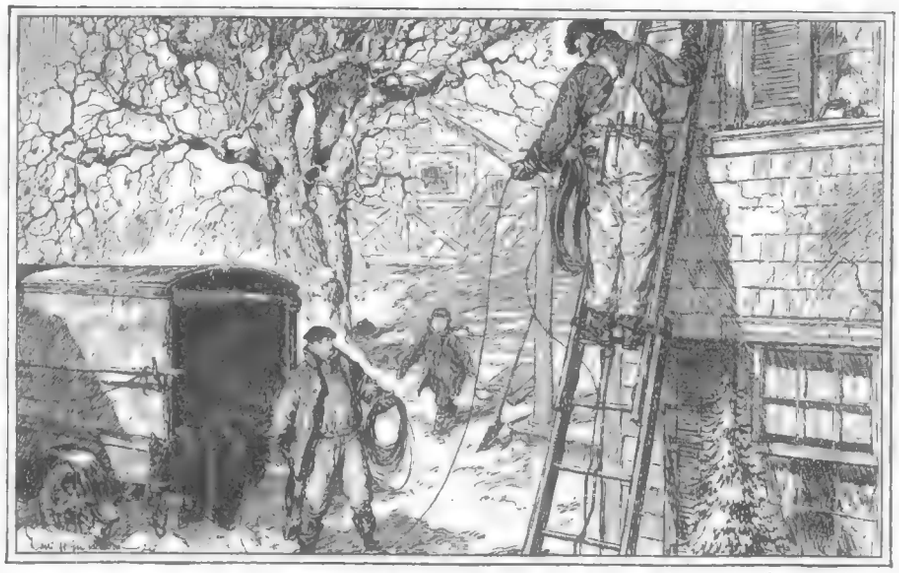
Remember that if the the coil L1 is coupled closely to L2 when the detector circuit is oscillating, the set will radiate. Therefore, keep L1 at right angles to L2 until the coupling between L2 and L3 is loosened, so that the detector circuit no longer oscillates. Then you will be sure that you will not create any interference.

As to the tubes used in this receiver, it has been found that the UX 199 type will give excellent results. The results are entirely comparable with those obtained when using UX 201A's, and in fact, the writer prefers the UX 199's as radio frequency amplifiers.

There is one thing that we like about UX-199 tubes and that is that they can be operated directly from 6-volt storage battery by using the proper size of automatic self-adjusting resistances. The current consumption is so low that one charge of the storage battery lasts a long time. The set illustrated was designed for UX-201A, but a UX-199 radio frequency amplifier can be used by substituting 6V-199 automatic filament control units for the rheostat R1.

THE TOOLS REQUIRED IN BUILDING THE DUO-REGENERATOR

Pliers, several kinds.
Screw drivers, several sizes.
Hammer, hacksaw and blades.
Hand drill.
Twist drills, several sizes.
Scriber.
Center-punch.
Soldering iron, electric or other type.
Wire solder, self-fluxing or plain solder and non-corrosive flux.
Rule, steel or wood.
Center finder for dials.
1 three or four cornered reamer and handle for expanding panel holes for shafts, jacks, etc.
Small tool and awl handle very useful.
Volt and ammeters for testing set, batteries, etc.
1 countersink.



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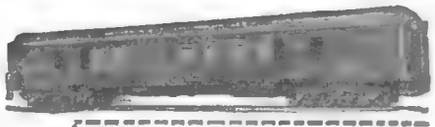

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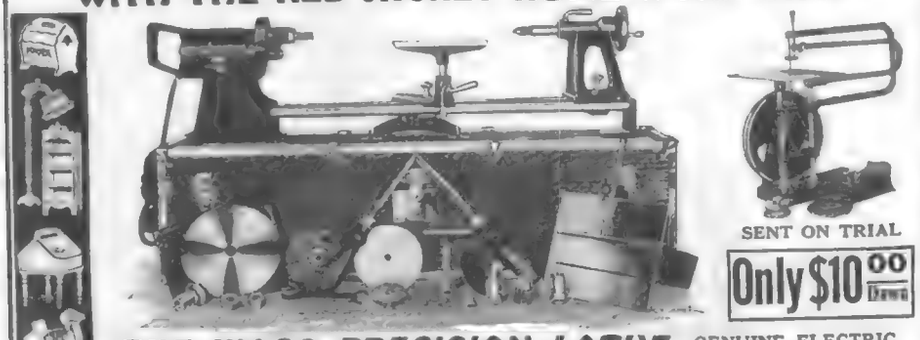

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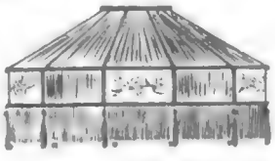

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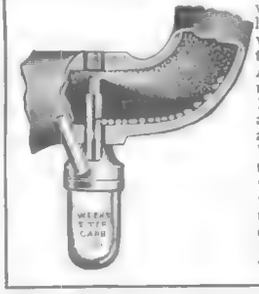

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AN AIRPLANE VIEW OF THE EARTH

Consider that the aviator is at point A of the diagram, eight miles above the surface and that he can see all of the region BC subtended by the angle BOC. In the right triangle AOB we have that cos AOB= 4000/4008 from which angle AOB is 10° 58′ and angle BOC is 21° 56′ or 1316′.

The length of BC is then given by $4000 \times \frac{1316}{60} \times \frac{\pi}{180}$ which equals 1567 miles. With perfect conditions of visibility such an aviator could survey a region extending from New York to within two hundred miles of Denver and from the Gulf of Mexico to a point far beyond the Great Lakes.

THE MIRROR PROBLEM

A person standing upright before a plane mirror can see an extent of his body just twice as broad and high as the mirror. Thus a six foot individual would need a three foot mirror to see a full length image of himself. A six inch mirror reveals only one foot of the individual using it. The size of the portion of the body that is visible is constant for all distances from the mirror.

These statements can be proven by the accompanying diagram. The eye of the observer is at E and sees an image of EA at E′A′. The mirror is at MN. By the law

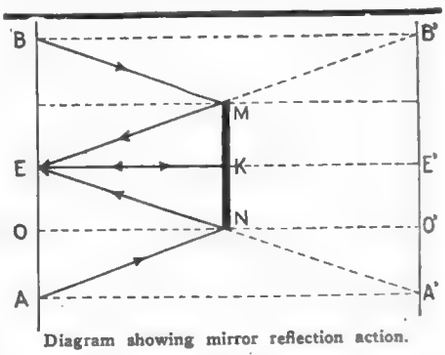

Diagram showing mirror reflection action.

of reflection of light the angle ANO equals angle ENO equals angle O′NA′. And ON equals O′N since the image appears as far behind the mirror as the object is in front. Hence by geometry and by the symetry of the figure the image E′A′ equals EA equals 2EO equals 2 KN. Hence the portion of the image that is visible below the level of the eyes is exactly twice the length of the portion of the mirror KN that is below the same level. In a similar manner it can be shown that that portion of the image that is visible above the level of the eyes is just twice KM. Hence the full image that is visible is A′B′ which is twice the height of the mirror MN. Since no assumption has been made regarding the distance of the observer it is evident that the portion of the image that is visible is the same for all distances.

THE EGGS

If the egg shell be considered as arch-shaped it will be seen that the pressure applied to the stationary egg on impact is all on the outside of the arch. This arch is very strong as any one will admit who tries to crush a healthy egg in his hands. The stress that is applied to the moving egg is a little different. In this case the moving contents presses all along the inside of the arch at the instant of impact and tends to spread it outward. This pressure is more effective in breaking the shell. In trying the experiment be sure that eggs of equal strength are chosen and that impact occurs on the same portion of the shells.

SWIMMING ON THE MOON

The buoyant force which any body of liquid exerts on an immersed body is equal to the weight of the displaced liquid. Since the pull of gravity on the moon is only one-sixth of that on the earth the weight of the displaced water would be only one-sixth as much. Hence the weight of the object and the buoyant force exerted on it by the water would be reduced in the same proportion and so objects on the moon would float at the same level that they would on the earth and there would be no advantage to the swimmer in this respect. Any exertion, however, which the swimmer made would be more effective in raising his body and so for those who feel that they must keep an undue portion of their body out of water a swim on the moon would seem much easier than one on the earth.

PUMPING UP AN INNER TUBE

The inner circumference of an inner tube is increased as it is inflated. When the tube is only slightly inflated it will be noticed that there are slight wrinkles around the inside. These disappear as the tube is pumped up. The change in size is also evident when the tube is measured before and after inflation.

JUDGING LENSES

To determine whether a lens is convex or concave, it should be used like a hand magnifier to examine an object. If the object appears magnified, the lens is a converging or convex lens. If the object appears reduced, the lens is a diverging or concave lens.

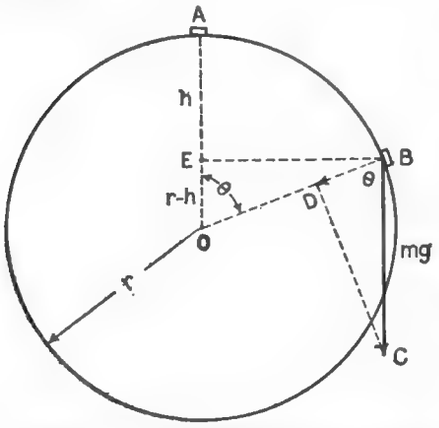

Diagram used in analyzing action of body sliding off sphere.

SLIDING OFF A BALL

As a body slides without friction from the top of a sphere the pressure of the body against the sphere decreases and the centrifugal force tending to throw the body off the sphere increases. If an equation be written equating the pressure against the sphere to the centrifugal force it is possible to solve for the angle Θ in the diagram to see if it is constant or dependent upon the radius r. As it turns out r disappears from the equation and Θ is found to be constant

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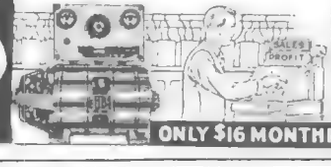

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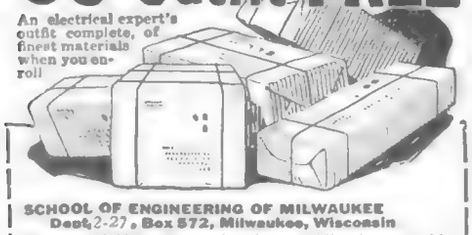
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and equal to 48° 11½′ for spheres of every size.

The full proof of this is as follows:

Let the radius of the sphere be r

Let the mass of object be m

Let the Θ be the angle subtended by the arc AB through which the body slides before the pressure of the body against the sphere is exactly balanced by the centrifugal force tending to throw it off.

When object is at B its pressure against the surface is represented by the vector BD which equals mg cos Θ

At the same instant the centrifugal force which tends to throw the body off the ball is

$$\frac{mv^2}{r}$$

If the two forces are equal the body will just begin to leave the sphere at point B

Hence $mg \cos \Theta = \frac{mv^2}{r}$

But in moving from A to B the ball acquires a velocity of $v^2=2gh$ (h=AE)

And from the triangle OEB we see that $r-h=r \cos \Theta$ or $h=r(1-\cos \Theta)$

Now by substitution we have

$$mg \cos \Theta = \frac{m\ 2\ g\ r\ (1-\cos A)}{r}$$

The quantities r, m and g cancel out leaving $\cos \Theta = \frac{2}{3}$ from which $\Theta = 48° 11½'$ regardless of the size of the ball, or the weight of the object.

The Indian Rope Trick.

By L. K. WRIGHT

(*Continued from page* 888)

the rope swung over the edge of a roof and, making certain that a billow of smoke hid his action, would drop to the roof and scuttle away. The fakir would continue to revolve, the smoke would grow less and the fakir would command the boy to descend. Upon receiving no reply he would seemingly grow angry and so jerk the rope that it would descend in a natural rope manner. The spectators would of course gasp and then display astonishment because the boy had not come hurtling down with the rope.

At a call from the fakir, a muffled voice would reply, which when traced would emanate from a wicker basket placed against the building wall, outside of the circle of spectators, and when opened with great show of unwrapping of rope and unlocking of fastenings, the boy who had ascended the rope, would be found, by an assistant, locked and sealed in the basket.

When performed by one of the Indian fakirs, an artist in his craft whose every motion commands attention, the rope trick is unsurpassed for effect. The construction of the rope is shown in the drawings. The sections are best machined from duralumin or from nickel steel rods, with hardened pins of the same material. Even with the best of high tensile-tested material, breakage may occur several times before a rope is ready for use; for the object is to keep the diameter of the finished rope down to normal size. The sheath may be of braided cotton, stained to the proper shade, and should be woven thick and firm enough so that upon flexure of the rope no bumps or protusions of sections are visible.

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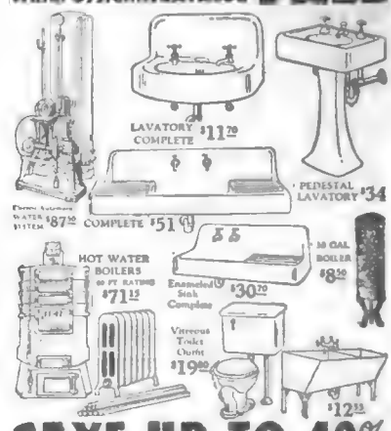

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Constructing An "N" Circuit Receiver

By JAMES FRANCIS CLEMENGER

(*Continued from page 927*)

easily constructed from a .0005 microfarad variable condenser and a 55-turn coil of the same type as those used in the set. This of course adds another control to the outfit, but it does not greatly complicate tuning and it will not be found necessary except under unusual conditions. One important point to remember is the fact, as was stated in the first part of this article, that any type of antenna-tuning arrangement may be used with this circuit, by cutting the grid and filament leads at the points marked X, and inserting the output connections of the tuning circuit in the place of the one specified in this set. This means that a vario-coupler may be used, that a few turns may be wrapped around the outside of the coil L1 and connected to antenna and ground to form an aperiodic antenna circuit, or that any other arrangement desired may be employed. We refer you also to the article appearing in the December issue of this publication.

The set as described in this article was found to give great satisfaction in a congested district of New York City. The experimenter will find that the value of the choke coil, L_3, will be an important factor in determining the selectivity and efficiency of the set. Try different values.

List of parts required for the "N" circuit:

L1 and L2, each 55 turns No. 26 D.S.C. wire wound on a 3-inch form.
1—.0005 Microfarad variable condenser.
1—.00025 Microfarad fixed mica condenser.
*C2, C3 and C4, each .1 to .01 microfarad fixed condensers.
*C1, .001 Microfarad mica condenser.
1—.001 Microfarad fixed mica condenser for detector plate circuit.
1—.0001 Microfarad fixed mica condenser.
*R4, R6 and R8 fixed resistances of 250,000 ohms each.
*R5, R7 and R9 fixed resistances of 500,000 ohms each.
R2 and R3, graphite compression rheostats.
R1, graphite compression grid leak.
J1, double closed circuit jack.
J2, single circuit jack.
Sw., filament control switch.
1—paned 7x12x3/16.
1—Sub-panel 8x11x3/16.
2—Base mounting brackets 1/4-inch high.
1—U.X. type socket for detector tube.
*3—U.X. type sockets for amplifier tubes.
1—Vernier dial, illuminated if desired.
Binding posts, screws, nuts and bolts as required.

(Parts marked (*) are included in the amplifier unit, and may be replaced with a commercially manufactured unit such as that used in this set. The name of the manufacturers of parts used in the construction of set described here will be furnished upon request free of charge).

How Loud Is a Noise

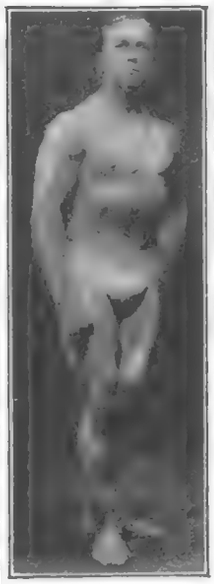
(*Continued from page 894*)

comparison tests.

The sound waves (Fig. 2c) from an outside source and whose amplitude is to be measured, are permitted to reach the ear through the opening between the two caps. The potentiometer is adjusted to zero, the phone unit held as in Fig. 2b, and the buzzer sound is gradually increased until it can be heard over the outside noise. At this point a potentiometer reading is taken, and after several tests a reliable average may be found for the sound under consideration. In Fig. 1 is given the amplitude chart for tests at the American Falls and Sixth Ave. and 34th St., New York City, two places famous for their noises.—

Photos courtesy Graybar Electric Co.

Are You Jealous of Your Physical Superiors?



Do you look with envy and hatred upon the man who stands out in a crowd the picture of health and vigor and strength—the real manly fellow? Do you sneer at the peppy pugilist, the powerful wrestler, the speedy runner, the graceful dancer—do you call them "big stuffs?"

Beware, man, if this is your feeling towards strong healthy men—you are filled with jealousy. You feel your own weakness. In your heart you wish you were like these fellows. You want to be strong and healthy. You want to command the attention of men and the admiration of women—you wouldn't be half a man if you didn't. You know your own weaknesses even if you are hiding them from others, and you envy those who are your superiors—those who seem to get the center of the stage wherever they are. They are the "life of the party" always, everywhere. They are the fellows that get all the promotions, all the good jobs.

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There's No Place For Weaklings

—and you needn't be a weakling—you needn't be jealous—you needn't have physical superiors—you can be strong and healthy yourself. You don't have to go on ailing and complaining. You don't have to be ashamed of your weakness—even though you know better than anyone else what brought you to your present condition. There's a way out of your dilemma. You are not different from thousands of others that have gone the pace, dissipated their strength and are paying the penalty. You can be put back on your feet. You can be made a 100 per cent man—energetic, vigorous, alert, ambitious, happy—a respected husband—a proud father—it's all up to you. It's for you to say whether you are going to go on a shiftless, useless derelict or an upstanding man among men.

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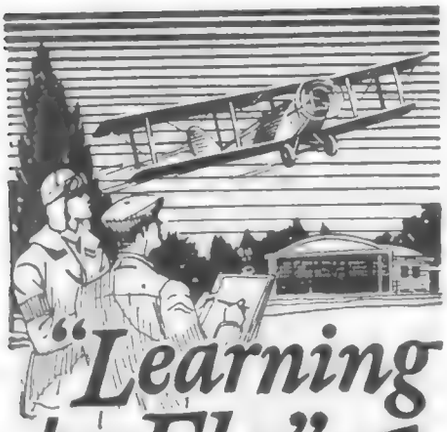

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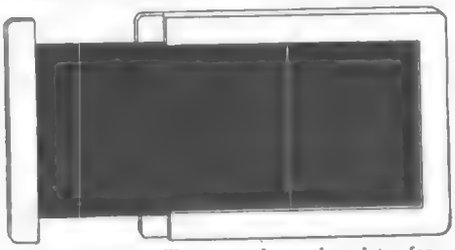
Our Spiritualistic Investigations

(*Continued from page* 905)

attached to the fact that his investigations had been viewed by many scientific celebrities, I persuaded the "Dr." to accept an explanation that his visit was an unusually welcome one, and I would be pleased to give him all the time his demonstration demanded. The short, stubby, gentleman, without further notice, quickly removed his top-coat, and carefully folded a black silk scarf that had been placed around his neck. A pair of glasses were quickly drawn from out an inner vestcoat pocket, and were affixed upon his nose, completing a facial picture of intelligence and distinction. "You are a disbeliever, I understand," the medium smilingly said. "Quite the contrary," I replied. "I am willing and anxious to be convinced. Although I did not discredit spiritualism, nor attack its religious value, I have not to date seen any psychical manifestation, that I considered convincing proof." The quick witted gentleman now proceeded to unfold a lengthly lecture, which was exceptionally impressive, and unusually convincing. He agreed that deception was practised by some mediums, and laid great stress upon the psychology of pointing out that nothing could be copied, without a model to copy from, and inasmuch as deceptive spirit manifestations were common, a true spirit control must be evident somewhere.



This diagram illustrates how the slate for producing this writing was constructed. It will be observed that even though the hand rests on the other side of the slate, the slide can be withdrawn, reversed and reinserted.

We exchanged viewpoints for fully one half hour, and, realizing that the "Dr." had a liking for prolonged conversation, my anxiety to see his product, grew as his talk progressed. Gifted with an excellent vocabulary, and a strikingly polite manner, it was difficult to persuade him to present his phenomenal offering which he was cleverly preparing me for. Lifting a large, black briefcase from off the floor, which he had placed there when he entered the room, he informed me that he felt assured that inasmuch as I had accepted his demonstration with an open mind, he would find no difficulty in proving his supernatural spiritual powers. He now detailed the most essential conditions, as he termed them. First, we were to be in the room alone. Appreciating as he did the high interest displayed by my representative, and gracious as he was in thanking him for having arranged the immediate interview, he insisted that Mr. Jones leave the room. Realizing the eccentricity of the medium, and understanding quite well that our wonder-worker had a hidden motive, my representative quickly consented, and left the room. Dr. Bowers had by now opened the straps of his briefcase, and brought forth what seemed to be an ordinary school slate, which he carelessly passed to me, and invited inspection. A quick glance showed this to consist of nothing more than a piece of heavy slate set into four pieces of moulding, which formed a frame around it. Without hesitance, the medium quickly proceeded to turn down the lights, which were quite numerous in the dressing room. One, after an-

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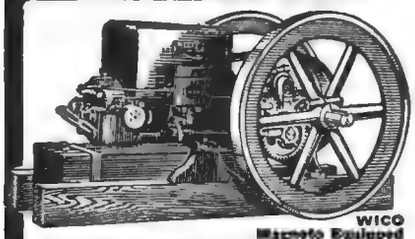

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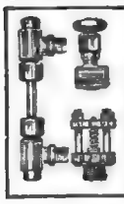

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other, the bulbs were extinguished, save for one directly overhead, which remained lighted. Although I scarcely had an opportunity to thoroughly examine the slate, the Dr. gently took it from between my fingertips, and holding it carelessly in his hands, emphatically impressed that no writing of any kind appeared on either side. Politely knocking all forms or methods, used by spiritual fakirs, as he termed them, he talked himself into a high state of excitement and personal admiration for the unusual power he was to display in his demonstration.

Lots of additional verbal description and self-praise followed, as the room was set for the test. This is what transpired. We were seated facing one another, well in the center of the room. A small stool, was placed between us. The slate was placed in the center of the stool, and after I was requested to place some mark of identification broadly across the center of the slate, he requested me to place the fingertips of both hands upon the slate, while he placed his hands in like position upon the opposite end. A small piece of chalk he carelessly tossed beneath the surface of the slate, and extinguished the one lone bulb that had still been burning. A few moments elapsed. The Dr. got up from off his chair, and turned up the one light again. He took pains to emphasize and impress that my finger tips had never left the slate, and it was quite impossible for any one to touch the lower side thereof, without disturbing my fingers or the chair. Neither of these however had been disturbed, I was therefore asked to prepare myself for a miracle. Pointing triumphantly at the slate, the Dr. advised me to turn the slate over. This I did without hesitance. A long message had been legibly written by the unknown force the Dr. spoke of. It read . . . this is a message to you, dear friend, from those who loved you. We still are with you, and will love you always. Happiness predominates here. Until we meet again, farewell. . . .

I looked at the smiling face of the medium. "Well," said he, "what do you say now?" "Only this, my dear Dr., that I will gladly award the prize to you, if you will permit this slate to undergo a thirty minute inspection right here in your presence, and if I fail to show you that it is prepared and tricked, I will be glad to recommend you as a candidate for the prize." The Dr.'s face grew pale. His voice grew loud, and his manner course. His former politeness had completely vanished. He claimed that he had been insulted, and threw the slate back quickly into his briefcase. Reaching for his hat and coat, and not forgetting his neatly folded scarf, he made so fast an exit that it would have been creditable to some motion picture star, registering an escape from a burning building.

The slate was constructed of two pieces of slate, which were held close together in the frame. The felt edgeing around this frame well concealed a sliding section, which had been so constructed as to enable the lower slate to slide clear out, while my fingertips held the upper one. As the manifestation took place in the dark, the Dr. had but to slide the lower section out and reverse it, then push it back in place. The message had been previously written, and thus concealed from view. The edge of the slate was so placed as to overlap the edge of the stool, so as to give the Dr. sufficient finger room to manipulate the slide easily.

More "Board Contest" Awards will appear in next issue

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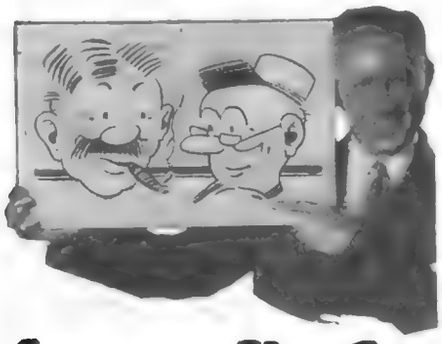

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City..... State.....

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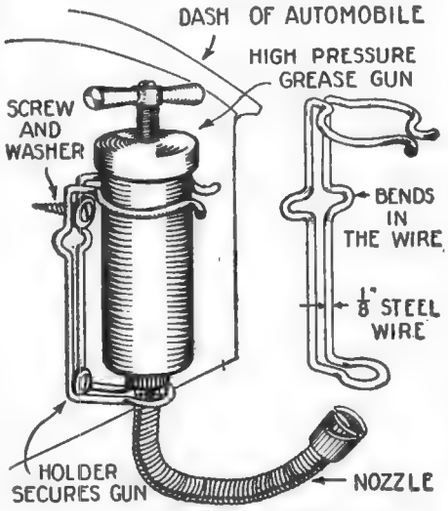
Motor Hints

By GEORGE A. LUERS

(Continued from page 909)

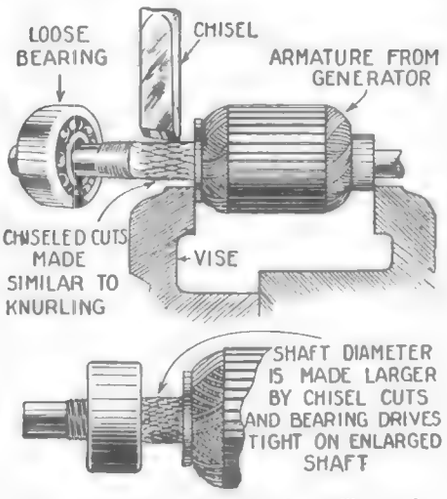
wire, is secured to the dash under the engine hood, into which bracket the gun is placed in a vertical position and ready for instant removal.



How to bend a piece of heavy iron or brass wire to form a spring holder for the grease gun. This holder can be mounted under the engine hood.

This fixture can be made up in a few minutes' time with a pair of pliers. Two screws and washers will as readily attach it to the dash of the car.

This will appeal to the car or truck driver, who has experienced the difficulty of clogging the nozzle of the grease gun or with dents in the body.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TWO BATTERIES SOLVE STARTING TROUBLES

The owner of a car who will equip with two batteries, certainly has the edge when it comes to starting.

The method of attaching two batteries is shown in the attached sketch and while it is a new idea, the worth of this method has been demonstrated to the writer by two motorists.

The second battery is placed in the rear deck of a roadster or under the rear seat of a five passenger car. The connections are

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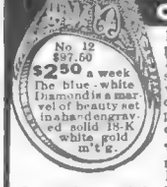
BIG VALUES IN GENUINE DIAMONDS
CASH OR CREDIT



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SEE PAGE 976

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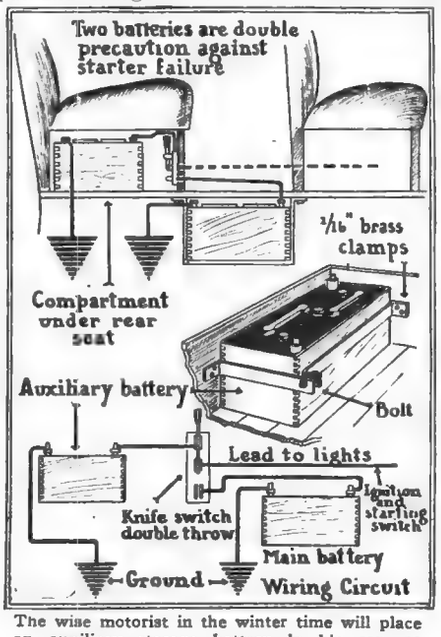
made through a knife switch, which has double throw and connects up either battery independent of the other.

It is advisable to install a strap for holding the battery secure, a simple means being shown in the sketch.

It is advisable to step up the generator output and charge batteries on alternate runs.



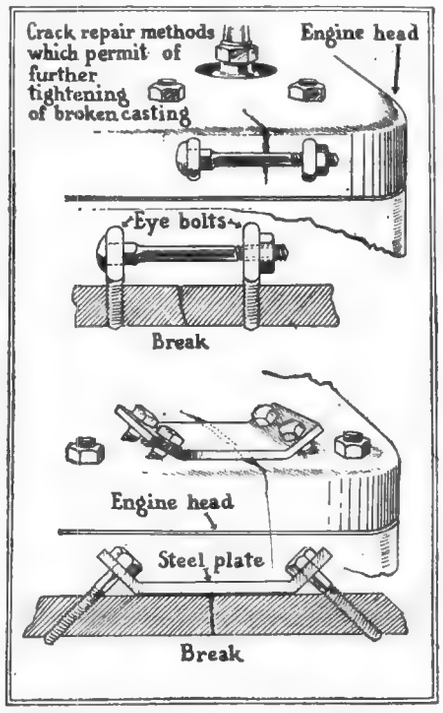
The wise motorist in the winter time will place an auxiliary storage battery in his car, as shown in the above drawing.

SEALING CYLINDER CRACKS

The first of these methods, is to drill and tap four, three-eighth-inch holes, two each side of the crack, into the cylinder casting.

Make or purchase four, three-eighth-inch eye bolts, with corresponding threads on the ends. Screw these in place and use two, three-eighth-inch stove bolts to pull the casting together.

The second means shown, is a plate to accomplish the same purpose. In this, the plate is drilled and bent so that the ends will allow of tightening. The cylinder is drilled from the plate, the holes being placed at an angle and a quarter-inch distance piece is placed behind the plate to throw the holes further apart.



Several ways in which to seal cracks in engine cylinders.

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Readers Forum

(*Continued from* page 923)

AMERICA'S MANUFACTURERS YEARS AHEAD

Editor, SCIENCE AND INVENTION:

Our greeting from this side of the world.

Fortunately I obtained a copy of your truly wonderful paper—I am more than happy with it and all it contains—we are one hundred years behind you all over here. I should so like to purchase some of the goods advertised and have told the advertisers I am writing to you about it. Any Post Office will change a money order into your bills. I trust that you will kindly help me should they write to you. We want your goods. Is there any sane reason why we should not be able to buy in confidence and complete trust? I pay the money into the British Post Office, the Bill of Exchange is forwarded and cashed and they send the goods—quite simple. Can you give any information where the dream instrument can be purchased. Doctors would like that here for the heart business. I have written to the Rasco and Van Horne Co., and many others. My order for your paper is now placed with an agent so I am sure of getting it. I suppose we are not acceptable for your paper in the way of contribution? There would be no harm in sending? I think a line in your paper for shipments abroad would do no harm. Not one advertisement mentions that they cater for the outside world—why is this?—what have we done? Won't you give us a shout in your next? Best wishes,

G. MAYOR,
N. Wales, England.

(We have sent you by mail the address of the concern manufacturing the dream machine about which you inquire. The editor is confident that many an American manufacturer will solicit foreign trade and will be only too glad to ship material to foreign countries in exchange for a money order.

Most American manufacturers have foreign agencies. America does not discriminate against foreign trade.

There is no reason why your manuscripts should not be accepted in SCIENCE AND INVENTION *Magazine. Inasmuch as the scope of our publication is International, we also have authors at various points of the globe who regularly contribute to this magazine. You will note that our special corresponding reporters in foreign countries are listed on the contents page of each and every issue.* —EDITOR.)

APPROVES GUN SALES

Editor SCIENCE AND INVENTION:

I wish to congratulate you on your stand regarding the sale of firearms. I have viewed with alarm the growing tendency to deprive law-abiding citizens of adequate means of protecting their lives and property.

Night after night I am compelled to be home alone until well past midnight, as my husband's employ-

$5,000 for Perpetual Motion

When SCIENCE AND INVENTION Magazine was still in its infancy, the editors denied the possibility of constructing a perpetual motion machine using those forces of nature as we now know them.

Since that time the editors have received thousands of different designs for perpetual motion devices, and have received hundreds of circular letters soliciting finances for the building of perpetual motion machines.

The editors know that if they receive these letters, there are thousands of others in this country who get similar letters and who fall for the claims made in the numerous prospectuses giving the earning capacities of the various machines.

Most of the shares of stock for these perpetual motion machines are being sold at a rate of $1.00 per share, although some inventors are trying to sell shares of stock at $100.00 per share.

Therefore the editors of this publication say, "Just come in and show us—merely SHOW us—a working model of a perpetual motion machine and we will give you $5,000.00. But the machine must not be made to operate by tides, winds, waterpower, natural evaporation or humidity. It must be perpetual motion."

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It costs you nothing to learn how to start in to make good MONEY right in your own HOME TOWN. We will give you THREE DIFFERENT PLANS, one of which Plans is the famous "Mail Order Plan" whereby you can earn MONEY, either by part or full time, in the Privacy of Your Own Room, or by mail, or by personal solicitation. Beside that, we will give you a list of TWO HUNDRED "HOME" and other OPPORTUNITIES. Nearly every kind of work, all this we give you WITHOUT EXTRA CHARGE. Simply fill in the space below, and mail this adv., and ONE DOLLAR, for a Full Year of "The HOME WORKERS' Magazine," a Magazine that specializes in giving articles on Applied Psychology and Ideas. Suggestions, and Plans for MAKING MONEY AT HOME. It is also an EXCHANGE for Buying, Selling and Renting Correspondence Courses and Books. (A copy of the magazine alone sent for 25c, none free). Remember you get these THREE MONEY-MAKING PLANS, and 200 OPPORTUNITIES FREE! Simply by subscribing to our Modern Progressive Constructive Magazine.

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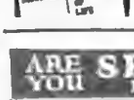

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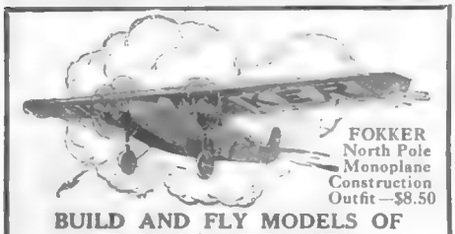

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ment calls for considerable night work during the fall and winter months. Our home is the only house on our block. I have never seen a policeman within a mile of our home. Several times I have heard prowlers around the house. Once our basement garage was entered.

The law can easily rob me of my only means of protection, but it cannot hope to disarm more than a small percentage of the crooks and burglars, and none of them permanently. These prowlers of the night would soon be discouraged if they knew that every household in the land was equipped with a loaded revolver, and that even the women and children were skilled in their use. This sort of protection for our home is even more necessary than the fire extinguisher.

I also believe an active campaign should be inaugurated against the hold-up men who are constantly lurking in dark alleys, and near many of the outlying transfer points of street railway companies. My husband and I have often been spotted or shadowed by such gunmen, and while in the past we have been able to outwit them or scare them off, if we had been armed as they were, we could probably have served society by capturing a few of them.

The sensible course would be, not to attempt to stop the sale of firearms, but to arm and deputize a large corps of volunteer workers. The records of these volunteer deputies should of course be first thoroughly investigated. There are many sources from which recruits could be drawn—the corner druggist, the restaurant proprietor, men who work night shifts, the clubman, the musicians in show or dance orchestras. There are thousands of men in the United States, whose legitimate activities take them abroad at night, and who possess the courage and ability to do their bit in rounding up the gunmen that infest our streets.

MRS. H. T. SCHULZE,
Independence, Mo.

(We thank you very much for your kind letter concerning the article regarding the sale of firearms which appeared in the last issue of this publication and we would state that you have voiced our sentiments exactly. We are not at all in sympathy with the movement to discontinue the sale of firearms. It is our humble opinion that every person in the United States has a right to bear arms to protect himself. That is a constitutional right. We have enough laws at the present time which, were they all enforced, would land us all in jail. Nearly every hold-up is witnessed by more than one individual.

The recent hold-up in New Jersey in which the bandits used machine guns to rob the U. S. Mails was witnessed by hundreds of spectators. In the crowd there were only three who were armed, besides the gunmen. They were the policeman who was mowed down and the two men on the truck who were shot before they could even get near their weapons. The spectators observed the number of the car as it drove away. Some of them knew that a hold-up was in progress. One woman in particular telephoned the police, who arrived too late of course. Had there been anyone in that crowd who knew how to use a gun, he could have made short work of at leaest one or two of the bandits and the others would have scattered insteaa of turning the machine gun on the prostrate form of the policeman as he lay in the road.

We are of the opinion that a law should be passed to permit every citizen to arm himself on condition that the number of his gun, the type and impression of a bullet fired from that gun as well as the cartridge be left at Police Headquarters. It would be easy to have the firing pin made in such a form that it would leave a numbered impression on the shell. The instant that any gun is lost, headquarters should be notified. The citizen should preferably be registered at headquarters and appear there, let us say, four times a year to have his gun examined, and to demonstrate his ability to use the same in an indoor rifle range.—EDITOR.)

DOES NOT WANT PRICE CHANGED

Editor SCIENCE AND INVENTION:

I take great pleasure in informing you that I have been a constant reader of SCIENCE AND INVENTION, for the past three years, and think it is the best magazine of its kind published. I quite agree with Richard Simpson of Indio, Calif., that SCIENCE AND INVENTION should be larger but I think you are right about the price as SCIENCE AND INVENTION is purchased by many boys who sometimes find it difficult to get even the 25c.

C. M. FABER,
Antwerp, Belgium.

(It may be remembered that Richard Simpson in the November issue suggested that we should increase the price of SCIENCE AND INVENTION *Magazine and increase the number of pages, as he would gladly pay more for this publication. We stated that the suggestion would not be looked upon favorably by many who now find it difficult to raise finances for the publication they most enjoy. Were it possible to decrease the price of the magazine, the editors would gladly do so. This requires a tremendous circulation, and a large advertising department. Both of these are constantly developing and eventually, this condition will obtain. Many of the readers know that* SCIENCE AND INVENTION *Magazine presents the news before any other scientific magazine on the market. Long before the Vitaphone was even exhibited,* SCIENCE AND INVENTION *Magazine gave the complete details of the mechanism. This was a "scoop" amongst scientific magasines. The photographs of why the Sikorsky plane failed to*

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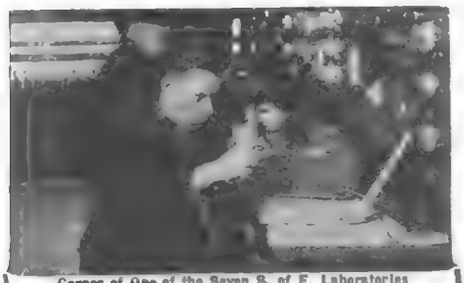

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cross the Atlantic is another "scoop" and we can name many others in every issue of this publication. —EDITOR.)

THE PEER OF ALL SCIENTIFIC LITERATURE

Editor SCIENCE AND INVENTION:

Enclosed is my much belated subscription for your estimable magazine.

It is with distinct regret that I am sending this a month late, but owing to the fact that I have been away on my vacation for over a month, your notice arrived in my absence.

As a reader of your wonderful publication for over seven years, nothing is farther from my thoughts than discontinuing it. The clear, concise way that you review the various occurrences in the scientific world are a delight to every reader and at the same time are within the grasp and understanding of all. The untiring efforts of the management of this magazine have been met with implicit confidence by the public, and SCIENCE AND INVENTION is accepted by all as the mouthpiece and herald of modern science.

It is, therefore, with great pleasure that I wish you continued success in your grand enterprise and hope that the magazine will always be considered the peer of all scientific literature, as it has been in the past. I am, your well wisher.

OTTO THORNING, JR.,
Cochrane, Canada

(Were it not for the fact that Mr. Thorning has been a reader of this publication for seven years, we would be inclined to assume that he was trying to flatter the magazine.

Our aim has been to make the magazine bigger and better every month. While it is frequently impossible to live up to the exact degree we have set for ourselves, because what may seem better to the editors may not be looked upon in that way by some of the readers, we are thankful to know that our work is being appreciated and judging by the constantly increasing circulation, we know that our readers also think so. We wish to thank Mr. Thorning and the many others, who have sent complimentary letters, for their communications. We also thank those who send us criticisms. The only way to improve is to act upon criticisms and accept the compliments as they come.—EDITOR)

Radio Wrinkles Wanted!

The Radio Editor, Mr. J. Francis Clemenger, wants to hear from you, if you have a good idea or wrinkle. Make a pencil or pen and ink sketch of the contrivance, write 50 words or so of description, and mail to the Radio Editor, c/o this magazine.

MORE BOOK REVIEW

Editor SCIENCE AND INVENTION:

Until you combined with the Experimenter, as a scientific magazine, your picture book was good to let the kiddies use for cut-outs. I have been taking the SCIENCE AND INVENTION ever since it was THE ELECTRICAL EXPERIMENTER, and although the EXPERIMENTER was better than the SCIENCE AND INVENTION ever has been, the new SCIENCE AND INVENTION is quite an improvement.

Are you going to continue the Experimenter Data Sheets, or let them drop? I haven't seen any notice about it.

Here's a suggestion. Why not have a full page photo each month of one of the leading scientists? (Edison, Steinmetz, Tesla, DeForest, Pupin, etc.) I think a lot of us would like to have pictures of these men framed and hung on the walls of our laboratories.

Another suggestion. In your Book Department give, besides comments, the names of the best scientific books of the year. Think it over.

T. L. SWEENY,
Anderson, S. C.

(In the days of the Electrical Experimenter, the forerunner of SCIENCE AND INVENTION we issued every month a photograph of one of the leading scientists which was a supplement to the magazine and which was intended for framing. At that time our readers were not particularly keen about having these photographs and consequently, the practice was discontinued. The Book Department of SCIENCE AND INVENTION Magazine will be increased and more book reviews will be published every month. We suggest that the readers cut out these columns and paste them in a book or else copy down the title of the book, the author and the nature of its contents on a card and classify the cards by subjects. In this way, a record of the best books of the year and the best books of all years would always be on hand for immediate reference.—EDITOR)

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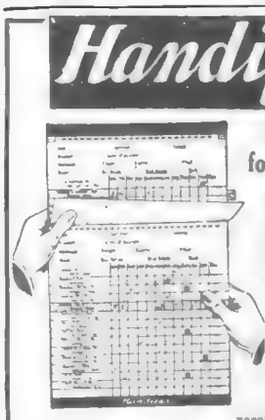

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The Astrology Humbug

By JOSEPH H. KRAUS

(*Continued from page* 913)

to work for the support of her mother and other younger children in the family.

She never traveled over seas consequently, she did not make any fortune through lands over the seas. Her longest journeys were excursion trips for the day and the only way in which these were connected with some story of marital pursuits, were because her fiancee took her on the trips. There never having been a marriage, there was no financial improvement through marriage. Financial circumstances prevented high living.

There was practically only one man in this girl's life from the time that she was mature enough to entertain company of the opposite sex, therefore, your statement of secret enemies, high living, and much company is likewise erroneous.

According to the horoscope which you yourself have developed, it would indicate that the facts expounded by you are more than ninety per cent incorrect. While it is true that astrology is given credence in the Bible, it is also true that this same subject is disproven in the same Work. —EDITOR.)

ASTROLOGY HUMBUG

Editor, SCIENCE AND INVENTION:

Have finished reading your article, "The Truth About Astrology" in SCIENCE AND INVENTION for October, 1926. A truly good magazine and an interesting article. It tends to argument though, (and "for the sake of argument" let's say,) I would like to state these few facts. (Can you deny them?)

Astrology is not a religion but a scientific study of the stars and planets. God made all these and rules all these.

It is a well known fact that insane people, asylum inmates, etc., are more greatly affected by a new moon than at any other time.

That the heat of the sun tends to make us doff our hats and coats. It is our brain that really makes us because of the knowledge that we will be more comfortable upon doing so, but it is the sun that moves our brain in that line of thought.

You know that Hiram E. Butler, (a more rabid non-believer of Astrology never lived, I believe) who fought against the truths of Astrology, studied this science, so that he would become better able to talk against it, finally realized the truth and then wrote the greatest and most well known text book on Astrology to this day.

You must realize that the idea of planets controlling us is farcical because, if you or I were told that we would meet our death through being hit by a train on a certain day, naturally, life being sweet to us, we would stay at home all day, never going outside the door.

In your example of the Dvorak twins, one married because her mind told her to, the other stayed single because her mind said no and probably because she was never asked, but that does not count against Astrology.

The same goes for the Holland twins, one was strong and with backbone, while the other was weak-willed and easily tempted.

As for Prof. Meyer, he certainly does contradict himself. The majority must not be judged by the minority. There are other good astrologers who are not fortune-tellers, but profess the belief that people's lives can be influenced (not led) by the stars and planets.

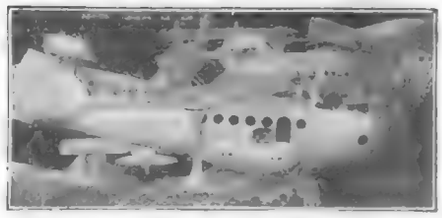
Why not print this and let us read what people have to say?

CLARENCE A. TIMONY
Brooklyn, N. Y.

(Your statement to the effect that insane people, asylum inmates, are more affected by a new moon than at any other time is not true. You should have written, certain inmates of insane asylums are apparently affected by the moon. They have a sort of psycho-neurosis. They associate the moon with other characteristics and it has a seeming influence upon them. These same people when put into a large dark room containing a projected image of the moon respond similarly. The moon does not actually have to be present. There are other individuals who fear police officers; still others who have a psychosis against dogs.

You will find that a great many people will put their hats on when the heat of the sun makes their heads uncomfortably warm. These are surely reasoning people. They know that by interposing some sort of a shade between the sun and the top of the head that the head will feel cooler. Some of them on the other hand, will remove their hats, primarily because, if perspiration, around the head is rather free it will evaporate when the hat is removed. Due to evaporation the head will be cooled. Your statement that it is the sun that moves our brain in that line of thought is therefore to be taken with more than a grain of salt. Different people react differently.

In our opinion the example of the Dvorak twins is perfectly logical. If you and your friend seat yourselves in the same coach of the same train, the influence of that railroad train on both your friend and yourself will be identical. It will take you both to the same destination. The only way you can prevent this is to leap out of the window while the



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train is in motion. We are assuming of course that the train makes no stops enroute. Consequently, the planetary influence on twins being identical, it should move them to the same line of thought and they should both be married or remain single as the case may be.

Your statement, in the case of the Holland twins, that one was strong, with backbone, and the other was weak-willed and easily tempted does not verify the truth of Astrology, but rather would tend to disprove it.

It is obvious that both twins should be influenced similarly and the mental abilities of both of them should have been identical. They were identical enough as far as facial features and physical build was concerned.

You also advise that Prof. Meyer certainly did contradict himself. If you have read the papers, you have noticed that Prof. Meyer also stated that Gene Tunney could not win and that Jack Dempsey must win the big fight. Of course, I assume that you are more or less of a fight fan and know that the result was nothing like the statement. Prof. Meyer made several other astounding predictions, which were given credit by the newspapers but when he failed, not one of them mentioned his failure. He is by no means the only astrologer in the United States as the second article on Astrology in SCIENCE AND INVENTION *Magazine showed. —Editor.)*

Editor, SCIENCE AND INVENTION:

In reference to the editorial on Astrology by H. Gernsback.

Will you prove by astrologers or text books on Astrology that Astrology considers the influence of a planet at the time of birth only and not before and after and that Astrology remains silent on this?

Will you prove by astrologers or text books on Astrology that Astrology states that every human being born at the same time all over the earth should have exactly the same horoscope and the destiny of each should be exactly alike?

I would like to receive this information very much, because, after 15 years' study of the subject, it is news to me.

JOHN THOMPSON
Orange, N. J.

(Every astrologer will notify you to give him the date of birth and the place of birth, and incidentally, the time, correct up to the minute, if at all possible. All Astrology books teach, that, as long as the child is still in its fetal stage and it has not been born, it is not to be regarded as a different entity but is to be considered as being in the possession of the mother, and the mother's life therefore rules the child. It is quite evident that should an accident befall the mother before the child is born, the child itself would likewise succumb unless an immediate Cesarian operation were made to bring it into the world alive. This could not take place if the child had developed to only the fifth or sixth month, before which most premature births do not survive. Inasmuch as you have studied Astrology for fifteen years you should know this. The inference which you obtained that human beings all over the earth are all controlled by the same stars should have read that those beings in a certain restricted area, governed, of course, by the latitude and longitude, are all controlled by the same planets. In New York City, for instance, all of the individuals born on January 11, 1926, should have the same destiny. Inasmuch as one hospital alone reported 62 births, it is not likely that all 62 of those will die at exactly the same time or that they will all be operated on at the same time, or that they will all have the same diseases, ailments, sicknesses and future. It is obvious that practically the same horoscope would have to be drawn for all of them. Astrologers, of course, lay stress on the exact time of birth, so there would be slight changes in the forecasts of each of these 62.—Editor.)

Editor, SCIENCE AND INVENTION:

Did you ever hear the story of the rubber ball and the toy flat-iron? It happened this way:

Tired of being toys for children, the Rubber Ball and the Toy Flat-iron decided to escape and see what was outside the nursery. Progressing as far as the window sill, they saw below them what was really (to our human intelligence) a glass-covered hot-bed with many plants inside it, but, of course, it was a mystery to them, so they resolved to investigate. The Rubber Ball jumped first, struck the glass, and bounced merrily upward, passing the iron on its way down. "No use looking," yelled the ball. "I've reached the bottom and there's nothing there." "Heck!" yelled back the Flat-iron. "That's not bottom for me! I'm going on through!"—and on he went.

After reading your editorial and Mr. Kraus' article on Astrology in the October issue of SCIENCE AND INVENTION, I must say that your general attitude strongly resembles that of the Rubber Ball. I believe both of you should read again that fine quotation of Huxley's that heads your editorial page. Also, although I grant you *personally* the right to use sarcasm and ridicule in dealing with a proposition contrary to your beliefs, it is a trait scarcely becoming in the editor of a popular science magazine. "There are more things in Heaven and earth, Horatio, than are dre'mpt of in your philosophy."

Truth is *everything*, and ridicule is a gas attack that has blasted many noble ideas and closed many paths to Progress. There are doubtless stone throwers who might have discovered gold mines if they had not been hasty and failed to observe a few winking grains of precious metal.

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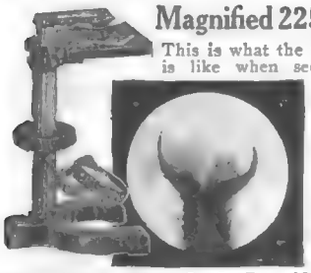

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You say, "It is ludicrous for any intelligent person to believe that a heavenly body can have any effect whatsoever," etc.

Why ludicrous? The planets certainly have an effect on each other, and all of them move in their orbits with mathematical precision. If they were not inter-related the solar system would be a chaos. We would be in constant danger of collision. It is certain, whatever Science may say about the matter, that some tremendous Law governs all the worlds of which we have any knowledge. Are there any known facts to prove that human beings (and other forms of life) do not move in orbits as do the larger bodies to which they are attached and of which they are a part? Granting this possibility, might not these orbits be determined by the relative positions of other stars and planets? You say, "Why should planetary effect be exerted at birth? Why not before or after?"

There are, of course, many possibilities to be considered, but my own version of this is that we do not really become separate entities until birth and separation from the parent. To make Astrology an exact Science, a tremendous amount of research would undoubtedly be necessary.

All the astrologers of which I know anything, require, in making a horoscope, not only the exact date, hour and minute of birth, but also the latitude and longitude at which it takes place. Every four minutes marks a change in the cycle, which means that the change actually is constant.

As to charlatans and "quacks"—they are to be found in every profession. The sample horoscope exhibited in Mr. Kraus' article is indeed a fine example of perfect nonsense, but Mr. Kraus himself admits that it is the most elusive in style of any in his possession. Some horoscopes read clearly enough and without contradictions, though few honest astrologers will attempt to give accurate dates or places for the simple reason that Astrology as a Science is not sufficiently rich in known facts.

I, myself, have a horoscope (it cost one whole dollar) that makes some extremely astonishing predictions. Whether guesses or not, several of the occurrences scheduled for my early life have verified themselves beyond a doubt. The rest, including the astonishing part, remains to be proven or disproven—but I do not care to make it public. I will say, however, that it is only a transcription in writing of a convicton I have had since earliest childhood. Some day I shall visit a reputable palmist and see whether or not the predictions coincide. I am not so much concerned with happenings of the future as with possible truths that may be yet undiscovered or overlaid with superstition. I know to a certainty that some so-called "fortune tellers" occasionally get a glimpse of the future with uncanny clearness.

Mr. Gernsback, permit me to say that your "logical" deduction about "predicted occurrences being avoidable" is not so logical as it sounds. Destiny is above human manipulation and the chances are that the person whose destiny is in question would find himself enmeshed in a chain of circumstances that would entirely prevent any self-governed action on his part—if, indeed, *any* of our actions are self-governed. There are many instances on record of people, who, having a fore-sense of impending disaster, went ahead and met it, powerless to save themselves.

I am not "pushing" the cause of Astrology but only the cause of Truth. Astrology is obviously not an exact science, but I do not agree with you that it cannot be made one, or that it contains no truth whatever.

Mr. Kraus speaks about gravity, light and psychic force as if he really knows what he is talking about. If he does—he is the world's wisest man. No man knows the power of light, direct, diffused or reflected. Psyche is merely a name for the great Un-understandable, and Gravity (if that is the proper name for it) is a force entirely mysterious and indefinable.

Mr. Kraus states that if the stars affect an individual they should affect a train or ship to a greater extent—a ridiculous assertion, so far as the immediate movements of the train or ship are concerned. A human being is a highly sensitive organism responsive to vibrant impulses of all kinds, whereas a train or ship is an inanimate mass normally under human control. The best of astrologers could not well predict the enormity of any disaster without following the paths of many people to a point of conjunction.

This is a long letter for a busy editor to read, but in the interests of Truth, I have been impelled to write it. I am not defending Astrology as it stands, but only the possible germs of fact that I believe it contains. We have indeed made great progress in chemical and mechanical sciences, but this should not blind us to the fact that there are more undiscovered laws than known ones, and that Science in general is encumbered with a great many unproven theories unfortuately accepted by the layman as fact. Because we can *see* no relation between widely separated occurrences, it does not necessarily follow that there *is* no relation.

I enjoy reading SCIENCE AND INVENTION and also *Amazing Stories* very much, but in feature articles I believe you should avoid ridicule and be exceedingly careful in a choice of words.

CLARENCE E. ALLEN,
Kansas City, Kansas.

(It is perfectly true that planets move in their orbits with mathematical precision. It is also true that planets are infinitely larger and the attraction and repelling force between them is infinitely greater than the effect of any and all of the planets on

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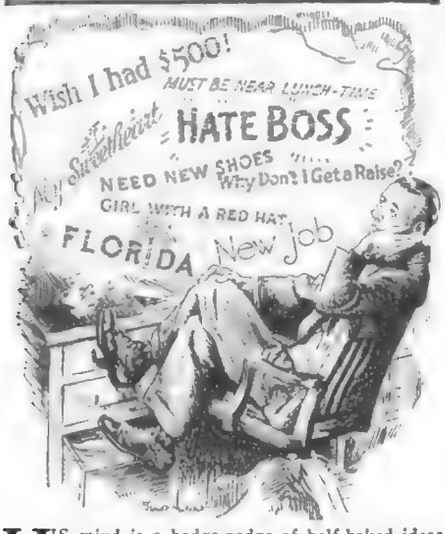

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man. This can be demonstrated very easily, it having been found that the attractive force of a body as large as the Woolworth Building at a distance of a third of a mile is about a million times greater than that of a planet such as Jupiter, the largest of all of the planets (with the exception of the sun) at a distance of 483,300,000 miles upon a man also positioned on this earth.

Your statement that it is not until after birth that an infant becomes a separate entity is one which we hold, but this idea is not held by all astrologers. Although we did not say so in as many words, we meant to infer that the astrologers require the exact date and minute of birth and also the latitude and longitude. We were referring in particular to greater New York, the latitude and longitude of which is practically the same, at least so far as astrological data is concerned. A difference of two or three miles is immaterial when one compares this with the size of the earth.

The statement that if the stars affect an individual they should affect a train or a ship to a greater extent is perfectly logical and is based on the fact that the force exerted by planetary influences upon a crowd should be infinitely greater than that on one single individual.

When a person gives bare facts it does not necessarily mean to say that he is deliberately ridiculing a certain profession. If we stated that Astrology was nonsense and then proved why we thought so, this would not infer that we are deliberately ridiculing astrologers. We are, however, proving to the masses that read our publication that Astrology is false and the main purpose of doing this is because of the great many letters which we have received in recent years containing questions concerning the subject. The more we write about it, the more will you also be convinced of the truth of all of the statements which we have made.

The mere fact that we offer money to prove Astrology indicates that we are just as willing to be convinced of the truth of that science, if it may be called that, as anyone else.

You might also say that we have ridiculed perpetual motion and spiritualism as practised by modern charlatans.

In both cases we offer handsome monetary prizes for proofs as to the truth of the end results.—Editor).

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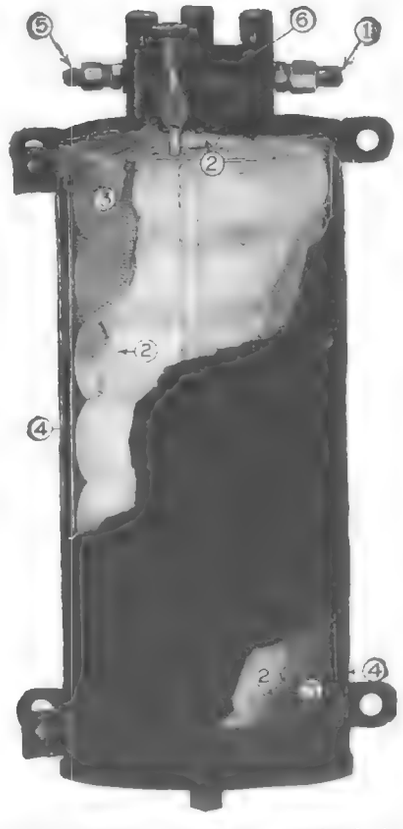

The illustration above shows a sectional view of the new oil filter which is now found upon a great many automobiles. The purpose of this filter is to filter out, from the oil, those fine particles ranging from two to five thousandths of an inch in diameter consisting of iron, steel, brass, dust, carbon, etc. The oil enters the filter from the crank-case at 1. It is forced into the tubular passages of the cloth bag and filters out through the bag, 2. The clean oil passes through the cylindrical screen, 3, used to support the cloth bag against excessive pressure, enters tank at 4 and leaves at 5 under pressure.—Photo courtesy A. C. Spark Plug Co.

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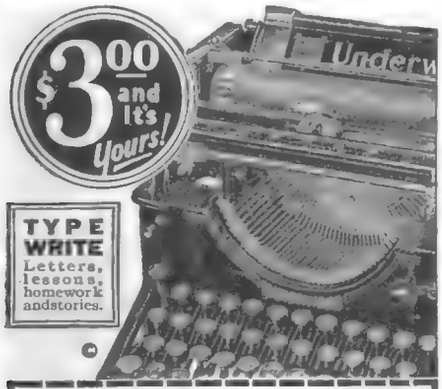

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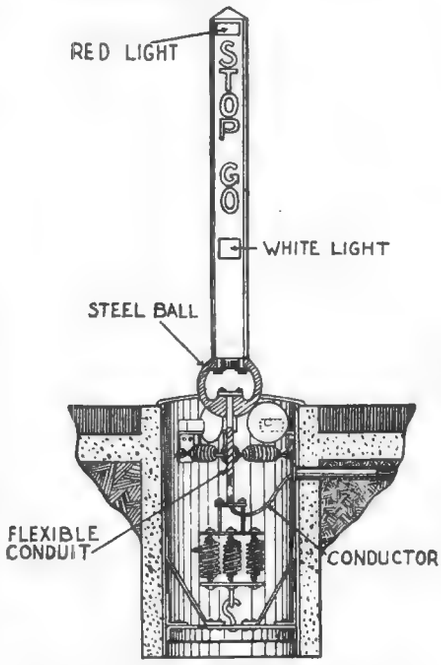

This is a view of the construction of the new traffic signal. It will be observed that the pillar itself is secured to a steel ball which in turn rests upon disc rollers. The signal is maintained in a vertical position by two sets of springs, one set pulling straight downward and the other set equalizing the pull from the sides. A motor driven flasher operates the lights.

Desk Set

A very artistic, serviceable and practical desk set is illustrated in the photograph below. At one side a well can be found into which the ink pencil fits. The pencil with its point constantly moist is thus ready for instant use. This article was designed by the famous sculptor, A. Zeitlin, whose lectures on sculpturing were broadcast from station WRNY.—Photos Courtesy Inkograph Co.

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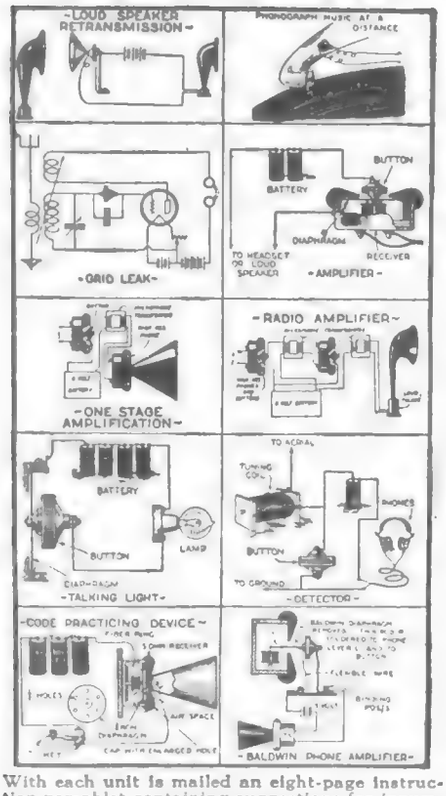

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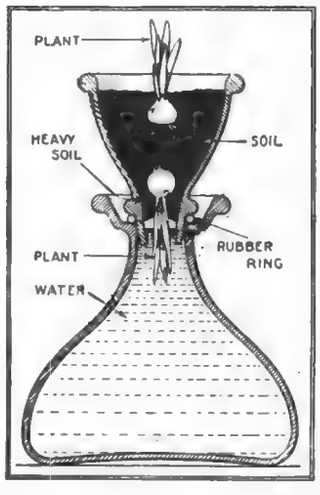
NOVEL PLANT GROWING JAR

The above photograph shows a rather unique and interesting plant growing jar recently invented by Leon Dentraygues, a florist located in Burlingame, California. It will be observed that it consists of two parts, a clear glass jar at the bottom and an opaque receptacle at the top in which the soil is placed.



The diagram above shows the construction of the plant growing jar. It will be observed that the top receptacle has a restricted opening at its bottom. Two plant bulbs are placed in the soil in such a manner that one will grow downward into the water and the other will grow up in the usual manner.

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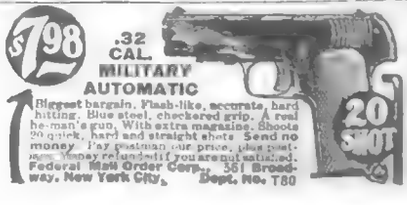

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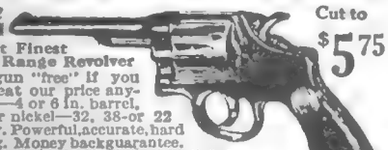
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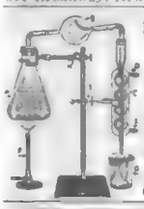
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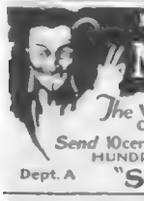
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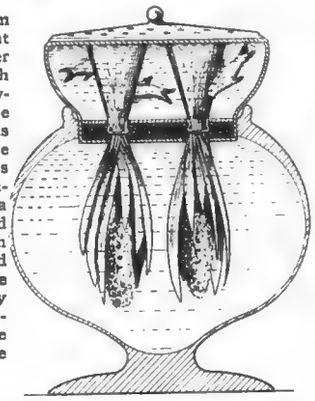
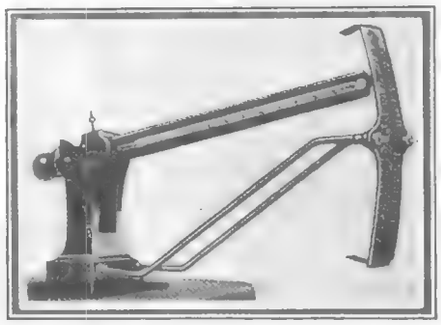
In this particular view of the novelty plant growing jar the reader may obtain an idea as to what the plant looks like when it grows downward into the jar and blossoms in the water. In this particular case no bulb was put into the top of the jar for an upward growth. Mr. Dentraygues, the inventor of this device has found that vari-colored hyacinths produce a very beautiful living bouquet when used in this jar. The plants themselves are watered in the usual manner, the overflow of water running into the expanded neck or saucer-like arrangement at the top of the transparent vessel. The opaque jar is of course filled with soil and the soil nearer the surface is of lighter consistency than that near the bottom.

The diagram at the right shows another way in which the plant growing jar may be used. In this particular case the hyacinths grow downward into a fish globe and the fish can swim around among the flowers or they may be maintained at the top of the globe.



One can see by the above diagram that it would also be possible to put bulbs in the top layer of soil so that they would grow upward. In this event the lid illustrated would have to be removed.

THERMOMETER FOR THE BLIND



As the mercury rises the thermometer becomes unbalanced and the top moves downward on the scale. Embossed readings along the sides and a projecting pin enable blind persons to very accurately read the temperature.

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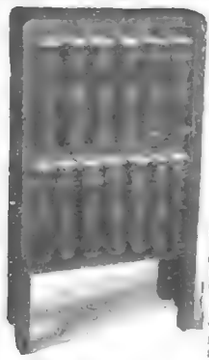

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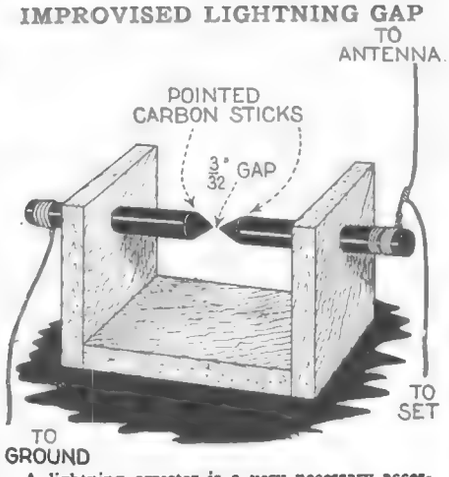
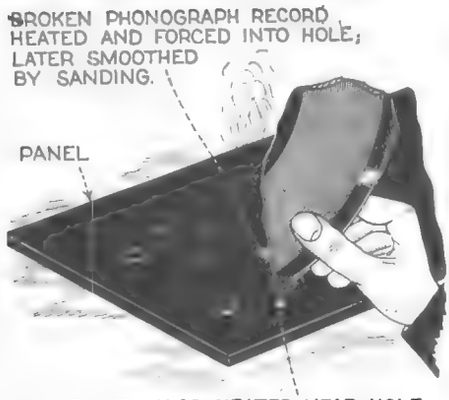


A lightning arrester is a very necessary accessory to the radio experimenter's apparatus. It is often necessary to make one on short notice, in which case the drawing above will indicate a very simple expedient.—David Borovitz, Rep. No. 21499.

PATCHING UP PANELS



PANEL ALSO HEATED NEAR HOLE

Old panels frequently resemble Swiss cheese, and present anything but an attractive appearance. Wax from a phonograph record may be melted to fill the holes, later to be smoothed by sanding.—W. L. Todd, Rep. No. 7791.

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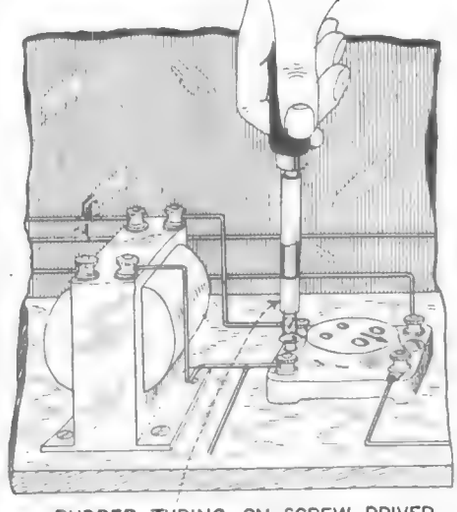

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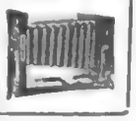

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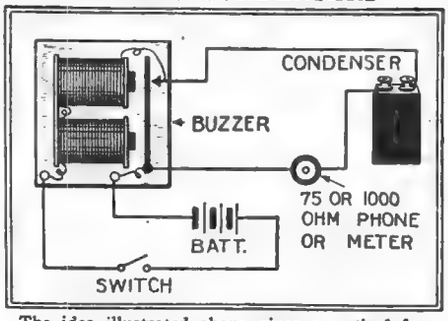
BOOKS REVIEWED

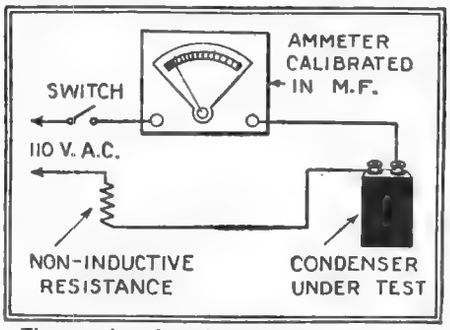
SCIENCE AND INVENTION has established a new 8-page section at the end of this issue with current reviews of latest books and publishers' advertisements.

TURN TO IT NOW

TESTING CONDENSERS

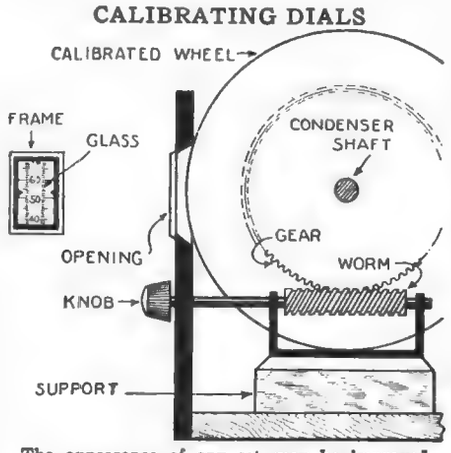


The idea illustrated above gives a method for simultaneously testing a fixed condenser for an open or short-circuit. If the condenser is open, no sound will be heard; if O. K., a sound of medium intensity, and if shorted, a very loud sound. —H. W. S.



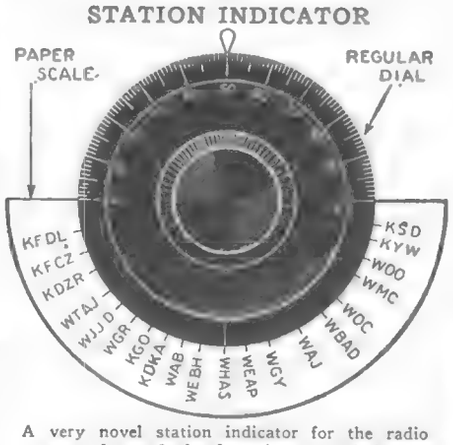
The capacity of condensers may be quite accurately determined in the manner shown above. The ammeter is calibrated to read directly in micro-farads. —H. W. S.

CALIBRATING DIALS



The appearance of any set may be improved by equipping the condensers with calibrated drums, the markings of which are viewed through a glass or celluloid window.
—Evermont Fisel, Rep. No. 2483.

STATION INDICATOR



A very novel station indicator for the radio set may be made by fastening a semi-circular sheet of white cardboard or white celluloid beneath the tuning dial. A scratch mark is made on the lower part of the dial, and filled in with white lead. The station call letters are filled in on the auxiliary dial.
—Evermont Fisel.

"The Boss Didn't Even Know My Name"

"He said my face was more or less familiar and he remembered seeing me around, but he didn't even know my name until the I. C. S. wrote him that George Jackson had enrolled for a course of home study and was doing fine work.

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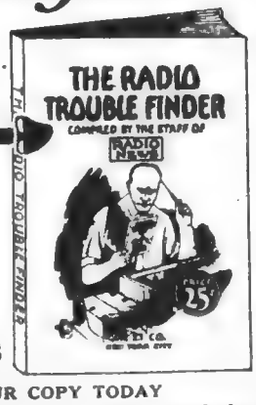

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SHIP MODEL MAKING. By Capt. E. Armitage McCann. 6¼ x 9¼, cloth bound, 130 pages. Well illustrated with working drawings. Published by Norman W. Henley Pub. Co., New York City, N. Y. Price $2.50.

Sometimes our hobbies, which are certainly very good things, take anything but a restful shape. Two vessels are selected as the subject matter of this volume. The first is the Lateen rigged Mediterranean craft, the "Felucca." The technicalities of the subject are admirably given; every little detail of construction is illustrated, even down to the quarter lanterns. Some constructors when they go to build a model, spend a good deal of money on the purchase of materials, but this book tells how to make beautiful money with practically no expense provided you have the tools, and what is more to the purpose, provided you have constructive ability. A Spanish galleon, a square rigged vessel with a lateen sail on her mizzen-mast is described at length with every single detail of construction given. Looking over the book has one very defintie effect, it makes one feel like starting to work at once. Whichever boat is made, the result will certainly be most decorative, and at the present day everyone wants a boat model in their home.

HOW TO MAKE A CLIPPER SHIP. By Capt. E. Armitage McCann. 6 x 9 inches. Cloth bound. Profusely illustrated. Published by Norman W. Henley Pub. Co., New York City, N. Y. Price $2.50.

This is a second book by Captain McCann which is a sequel or a second volume of a set on ship model making, the book reviewed above being Vol. 1. The subject is Donald McKay's famous clipper "Sovereign of the Seas." She was launched in the days when five yards were crossed on the mast, before double topsails came in, and later we even find double topgallant sails carried, so that there may be seven or eight yards crossing the mast.

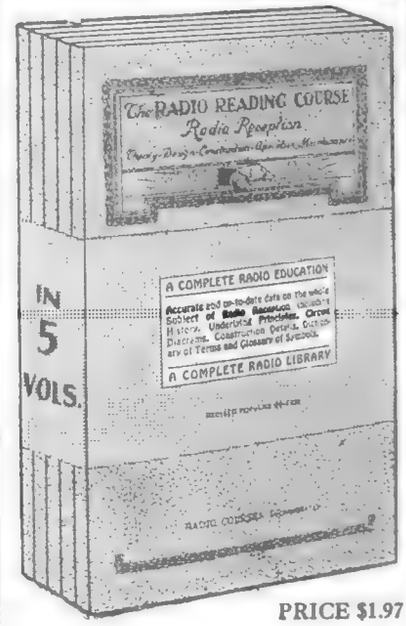
Just as in Vol. 1 every little detail is given, and given in such shape that it can be made by the amateur, and he certainly will prize the ship which he has built far more than a purchased one. And there is another hint to be given in connection with these two books. A person who has time on their hands can make models which can be sold, and can convert an amusing occupation into a profitable one. Almost the most beautiful creation of man is a full rigged ship, and in spite of all modern improvements, the old time clipper is as beautiful as any of them.

POPULAR CHEMISTRY, by James R. Wright. Soft covers 6" x 9¼", 15 pages. Published by Popular Chemistry Co., Caldwell, N. J. Price $1.00 a year.

This is a pamphlet of a little over twelve pages rather attractingly got up and forming one of a series being published at ten cents a piece. The subjects of this particular issue are extremely interesting and timely and what makes it more valuable is that it gives simple experiments and that a page or so is devoted to questions which are answered. There are also some chemical recipes and the advertisements as far as given will form a useful part of the book.

PHYSICS FOR COLLEGES, by H. H. Sheldon, Ph. D., C. V. Kent, Ph. D., C. W. Miller, Ph. D., and R. F. Paton, Ph. D. Stiff cloth covers 5½" x 8¾", illustrated, 624 pages. Published by D. Van Nostrand Co., New York City. Price $3.75.

Four states, New York, Kansas, Rhode Island and Illinois have supplied from their colleges the four authors of this valuable book. Such a work cannot be adequately reviewed in the space at our disposal. Turning over the pages we see an interesting mixture, if we may express ourselves in a popular way, of the old and the new. The new bears the impress of excellent treatment, and the writer who has had a good deal of experience in the field of physics as lecturer and teacher sees much that is good in this work, and it impresses him with the idea that it really gives a complete resumé of its subject, and although necessarily condensed within a small compass, it does seem to cover its subject. Its name indicates that it is for college use, but those who are interested in physics, and there are many now, will find it a valuable addition to their library to be read, even if not closely studied.



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POPULAR RESEARCH NARRATIVES, collected by the Engineering Foundation. Stiff cloth covers, 5" x 7½", 174 pages. Published by The Williams & Wilkins Co., Baltimore, Md. Price $1.00.

The best review that we can give this book is simply to advise our readers to get it. It is made up of fifty short narratives on scientific topics, each by a prominent authority. It is absolutely surprising to see how much interest can be put into articles of only three or four pages. It is the second of a series being issued under the auspices of the Engineering Foundation. There is an excellent index.

THE FUNDAMENTAL CONCEPTS OF PHYSICS IN THE LIGHT OF MODERN DISCOVERY, by Paul R. Heyl, Ph.D. Stiff cloth covers, 5" x 7½", 112 pages. Published by The Williams & Wilkins Co., Baltimore, Md. Price $2.00.

A work emanating from the Bureau of Standards of the United States carries with it much respect. This book is divided into three sections taking up three centuries, the eighteenth, the nineteenth and the twentieth; the first the century of materialism; the second that of correlation, and the third that of hope. The book is written quite poetically yet on a very strict scientific basis, and its (about) one hundred pages contain a very wonderful presentation of the subject. At the end there is an interesting table of references, and we gladly recommend it to our readers.

MARCH'S THESAURUS DICTIONARY, by F. A. March, LL. D., L. H. D., DC. L., Litt. D., and F. A. March, Jr., A. M., Ph. D. Stiff cloth covers 7¼" x 10¼", 1190 pages. Published by Historical Publishing Co., Philadelphia, Pa. Price $9.00.

It hardly seems necessary to attempt a review of March's Thesaurus, for it would come perilously near to attempting the impossible. The work, which by the way, is the only reference book known, to whose inventor, for such he must be called, a patent was issued, is as standard a book as Webster's dictionary. It is more than a dictionary or list of synonyms, for it gives often under a single word not only a quantity of synonyms, but the definition of each, the beauty of which is that the writer or student can select a synonym corresponding to his exact idea. The definitions are very short, as a rule each one taking a line or less, and the excellent system is certainly one which would add to the definiteness and precision of one's idea. Every writer should have this on his desk. None of us are faultless. The first line of "Paradise Lost" contains imperfect prosody where the word "first" is taken as a short syllable. So that we may say that if Milton had had this Thesaurus at hand, even he, the great master of English, might have used it with satisfaction.

THE HEAVENS, by J. H. Fabre, Translated by Dr. E. E. Fournier d'Albe. Hard covers 5¾" x 8¾", 336 pages, illustrated. Published by J. B. Lippincott Co., Philadelphia, Pa.

We would recommend this charming book to the rabid type of evolutionists. One of the greatest physicists in the world has given us a warning not to accept scientific statements on theories as absolute known facts, because they are always subject to modification. and to distinguish between the theories which are only theories, and actual facts. The book is meant largely for young people, and instead of being divided into chapters by name, while chapter-like divisions exists, they are called "lessons." We say this because the well-known author, who has won great fame for his charming books, and whose life is a lesson in itself, does not hesitate to assert his belief in the supernatural. The style is simple and poetical and the ground covered in twenty-five lessons with numerous illustrations includes the earth, time, the mechanics of celestial bodies, the atmosphere, the moon, and so on right through the great subject. We are sorry that the translator did not put in an index, for the book is beautifully printed by the old Lippincott house, and certainly deserves this attention.

DER KAMPF UM DEN NUTZEFFEKT IN DER TECHNIK, by Dr. H. Schutze. Stiff cloth covers, 5¼" x 7¾", 94 pages. Published by Died & Co., Stuttgart, Germany.

Some people feel that too much is being done in the direction of efficiency, that the poetry of life in a sense is being interfered with by the constant striving after economy in our factories. The building of an automobile on its great traveling stage certainly must stultify the men who work on it year after year, and the high wages which they get for the first five years are acquired at the expense of their personality for they themselves in a way become machines.

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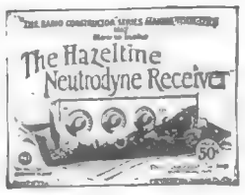

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- Can We Radio the Planets? by Hugo Gernsback.
- Radio Photography and Television by Dr. E. F. W. Alexanderson.
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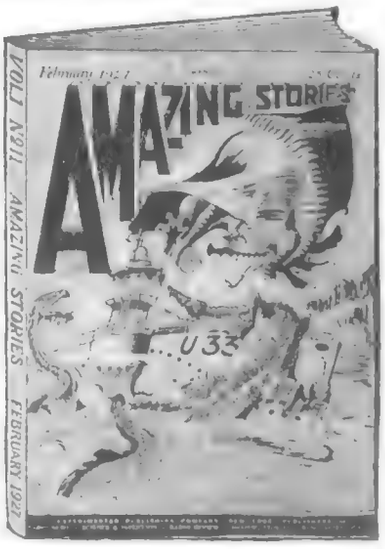

Some of the big feature stories of the February issue just out are:

- The Land That Time Forgot by Edgar Rice Burroughs.
- On the Martian Way by Capt. H. G. Bishop, U.S.A.
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PARIS OR THE FUTURE OF WAR. By Capt. B. H. Liddell Hart. Stiff cloth covers, 4½"x6¼", 86 pages. Published by E. P. Dutton & Co., New York City. Price $1.00.

This new edition to the "To-day and To-morrow Series," published by Dutton, is a very commendable little work and should be read by everyone. Captain Hart discusses the true objectives of war as well as the future of war. He takes up the air weapon from both its negative and positive phases; objections to air attack; are armies obsolete?; the naval weapon; the army weapon and the evolution of the new model armies. There is some very fine philosophy and vision in the closing chapter of Captain Hart's book, from which we quote below:

"How can the respective arms protect themselves against gas? Aircraft, by rising above it; tanks, by being air-tight and producing their own oxygen inside; infantry, cavalry, artillery, by the use of some form of respirator. A respirator is only proof against known kinds of gas; it cannot be worn for long without incapacitating its wearer from active exertion; it cannot protect the whole body, unless it be developed into a complete diver's suit, in which movement would be almost impossible. If a man cannot move freely, he cannot fight. If a horse cannot move, what use is his rider? If the artillery-man cannot serve the gun freely and the gun is immovable, field artillery is useless. Therefore, if gas becomes a standard weapon, we are left with the tank and the aeroplane as the sole effective arms for offensive action."

POPULAR MAGIC. Prepared by the staff of SCIENCE AND INVENTION Magazine under the direction of Prof. Dunninger; edited by Joseph H. Kraus. Soft covers, 8½" x 11¾", profusely illustrated, 112 pages. Published by the Experimenter Publishing Co. Inc., New York City. Price 50 cents.

This book on magic for the ridiculous low sum of fifty cents, is worth at least $5.00, and some magicians have stated that it is worth at least $10.00. Many of the tricks described and illustrated in full detail in this marvelous book on magic will cost you $5.00 to $10.00, and as high as $50.00 in some cases, if you had to buy them from a magic apparatus dealer. If you have ever purchased any small pocket tricks from a magic supply house, you know that they are not very cheap. Some of the cleverest tricks you ever dreamed of and extremely simple to perform, are fully illustrated and described in very simple language in this entertaining and valuable work. Several large articles in the book are worth more than the price of the book itself, are described. For instance:—how some of the great stage magicians escape from huge cans full of water; how a lady disappears mysteriously from a cabinet; how an elephant was made to disappear through a brick wall, and other astonishing tricks which you could hardly believe possible if you did not have the opportunity of seeing them illustrated in detail in this new book.

TALES FROM NATURE'S WONDERLANDS by William T. Hornaday, Sc.D., A.M. Stiff cloth covers 6½" x 9", 235 pages, illustrated. Published by Charles Scribner's Sons, New York City. Price $2.50.

Dr. Hornady is recognized as a charming writer on nature topics. Here he has gone outside the field of his own personal work and has produced a popular book touching on all sorts of topics on natural history dealing with the observations of many other scientists, and even going into regions of information touching upon the animals of prehistoric ages. Numerous illustrations add to the interest of the book and especially those covering the reproduction of animals from fossil remains are to be referred to, presenting an amazing picture of what the world was thousands of years ago. The description of the wonderful penguins of the Antarctic recalls a most interesting moving picture which was exhibited here some years ago. The New York Zoological Park, which is Dr. Hornaday's inspiration for many of the topics, contributes not the least interesting part of the book.

PROFITABLE SCIENCE IN INDUSTRY by Dwight T. Farnham, C. E., H. E. Howe, R. W. King, Prof. J. A. Hall. Stiff cloth covers 5½" x 8", illustrated, 291 pages. Published by The Macmillan Co., New York City. Price $3.50.

Four authors appear in this work which is devoted to bringing out the point that science is a money-making proposition. Many young men, and old ones also, find that it is a low-salaried proposition. We recently reviewed a book on office management, and in this book a good deal comes in about efficiency, and we find the name of Taylor quoted in the beginning of the eleventh chapter. Efficiency is in the order of the day and such books as this may be unhesitatingly recommended as good reading, although the value in this case is impaired to a certain extent by the lack of an index.

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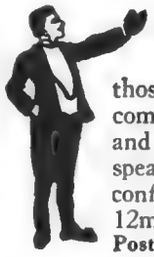

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ELEMENTARY PRINCIPLES OF PHYSICS by Robert W. Fuller, Raymond B. Brownless and D. Lee Baker. Stiff cloth covers 5" x 7½", illustrated, 859 pages. Published by Allyn & Bacon, New York City. Price $1.80.

This very attractive school book comes from the Stuyvesant High School of our city and presents a very nice treatment of what used to be called natural science, somewhat as if any science was unnatural. An idea of the scope can be gotten very well by turning over the pages and looking at the illustrations. These are so numerous that they practically tell the story, and we find not only that, but that they are very much up to date; thus, under "Light" we find two pictures of the great Mt. Wilson reflecting telescope. It has nearly 900 pages, but the range is so great that this hardly suffices, and this limitation has had the inevitable effect of making each subject briefly treated. All through it there are questions given which are interspersed with the text, and each set of questions covers but a few pages. This, to some extent, makes it a catechism, and we know how popular scientific catechisms have been. When we say the book is a condensation of its popular subject we have described it in a few words.

SOURCES OF VOLCANIC ENERGY by John C. Soley. Stiff cloth covers 6" x 8¾", profusely illustrated, 247 pages. Published by G. P. Putnam's Sons, New York City. Price $3.50.

In its authorship, in the print and paper, in the very numerous illustrations, nearly sixty in number, with its maps, this work on the face of it is a most creditable production. Seismic disturbances of late years have excited much interest among those not affected and have occasioned dreadful disasters for the Japanese and for the inhabitants of other countries where such disturbances occur. So this work seems very timely and the treatment of the subject is thoroughly up to date. The subject of terrestrial heat which is at the bottom of volcanic and seismic disturbances undoubtedly is a much debated subject and has not yet been satisfactorily settled. A great portion of the book is devoted to volcanoes and next earthquakes come in and are elaborately treated. The author says that while volcanic explosions are stupendous and can always be seen, they are tame beside the tremendous power and the insidious force of the earth wave. In an example of the treatment we find radiant energy even down to radium emanation treated and a study of the gases collected from mineral springs and volcanoes is included. Very interesting pictures of the destruction done by the San Francisco earthquake and of the Messina waterfront before and after the earthquake give vivid portrayals of what old Mother Earth can do when she tries.

WHAT ARE YOU GOING TO BE? By Hallam Hawksworth. Stiff cloth covers 5" x 7¼", illustrated, 245 pages. Published by The Century Co., New York City. Price $1.75.

The Latin poet, Horace, in his famous satire says that no one is satisfied with his occupation. In the preface of this work we find the quotation from an American philosopher t the effect that "Every man knocks his own business but sticks to it like glue," which is a pretty good paraphrase on Horace. The book may be to a certain extent judged by the portraits given in it which form the only illustrations. They range from Steinmetz to the famous Bishop Brooks, and represent eight successful men. That is to say, successful in fame or in cash. The text is largely devoted to advertising ways and incidentally to selling methods, credit, overhead and exact superintendence. It is full of personal anecdotes, but it makes really capital reading. Even criticism of literature comes in, and the methods of authors such as Dickens and George Elliott are most attractively given, and the personality of the treatment of the subject of the book is accentuated where the author speaks of what the writers did. Edison's work then comes in. One short section is devoted to the blueprint and blue overalls, which is cited as an example of the picturesque presentation of the multifarious topics of this book.

OFFICE MANAGEMENT by William Henry Leffingwell. Stiff cloth covers 5½" x 8½", 833 pages. Published by A. W. Shaw Co., New York City. Price $5.00.

The famous life-work of Frederick Winslow Taylor, one of the pioneers of efficiency engineering, has given his name to a society devoted to this subject, of which our author is a member, so here departing from mechanics and factory management we come down to the minutiae of office detail for securing efficiency, and the author goes right down to the smallest item. Thus we find filing cabinets, tabulating machines, dictation to the Ediphone and stenography all treated at length. Psychological tests, employment methods, training method, adequately described may be taken as giving a sample of the pages. A double column, nine page index closes the work, which we warmly recommend to our readers interested in the subjects named.

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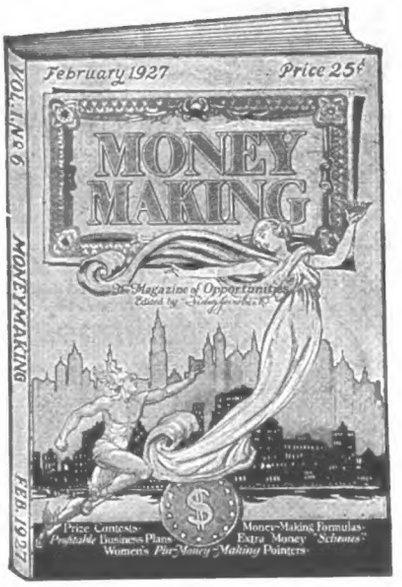

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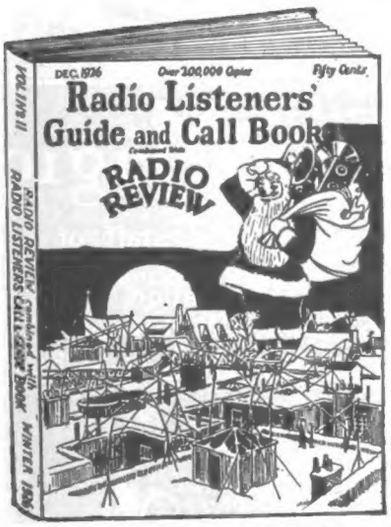

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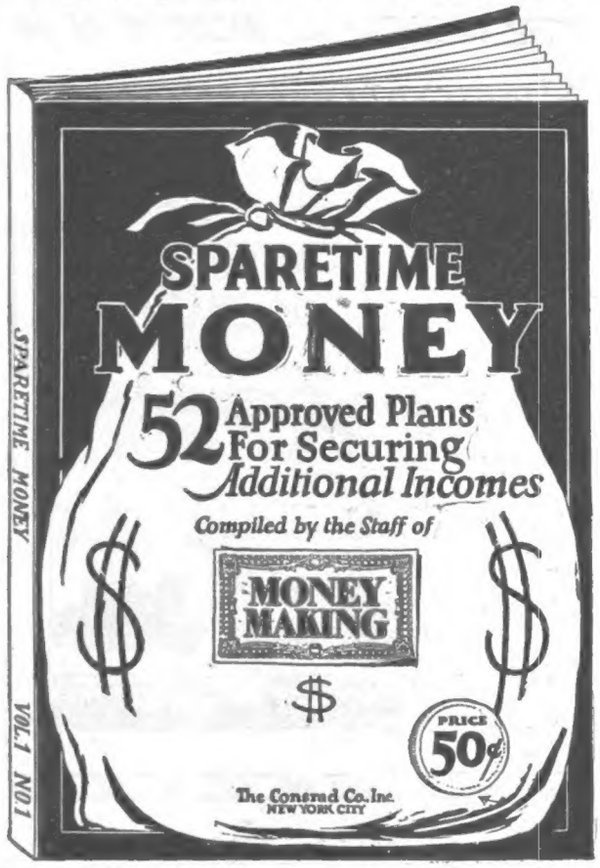

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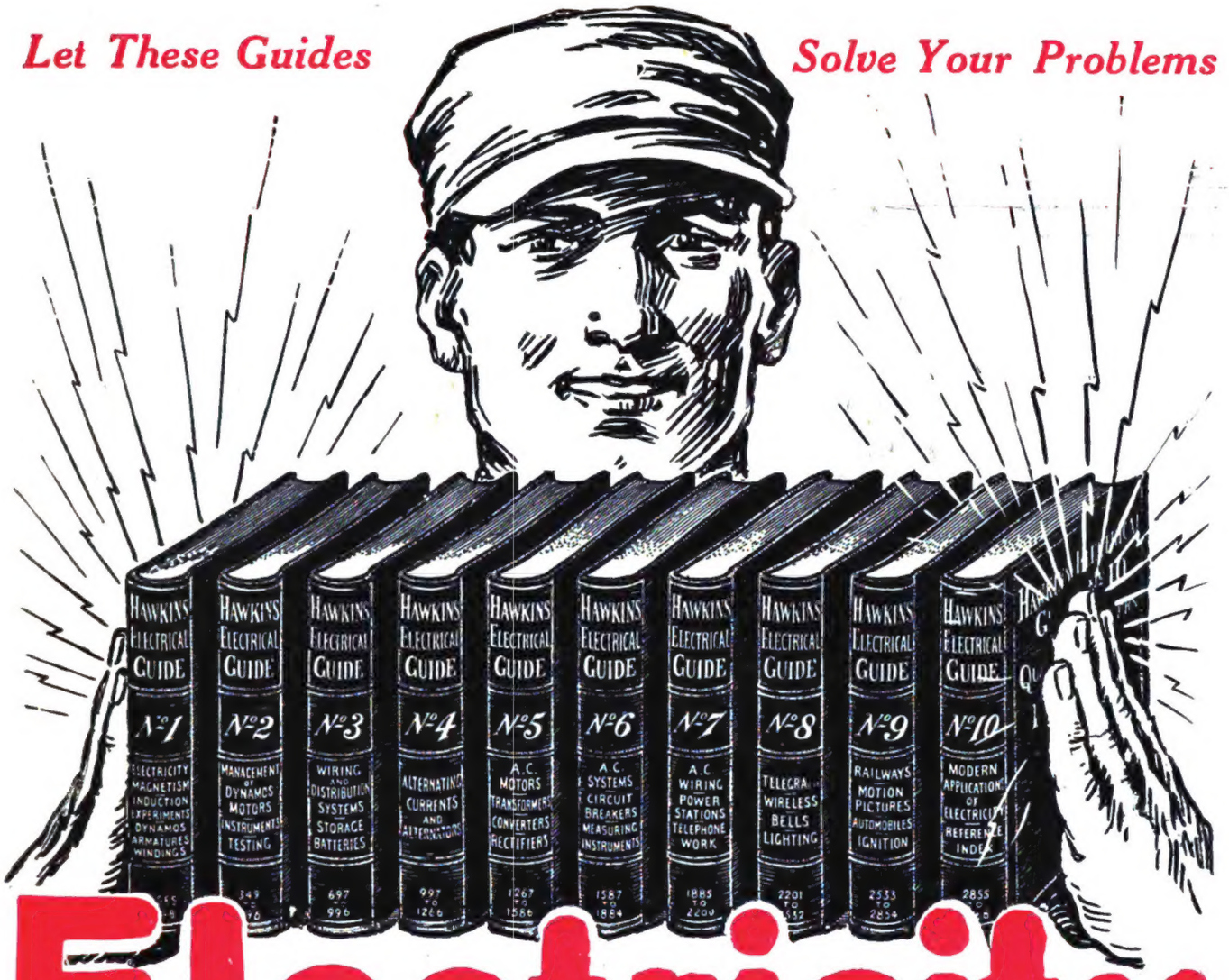

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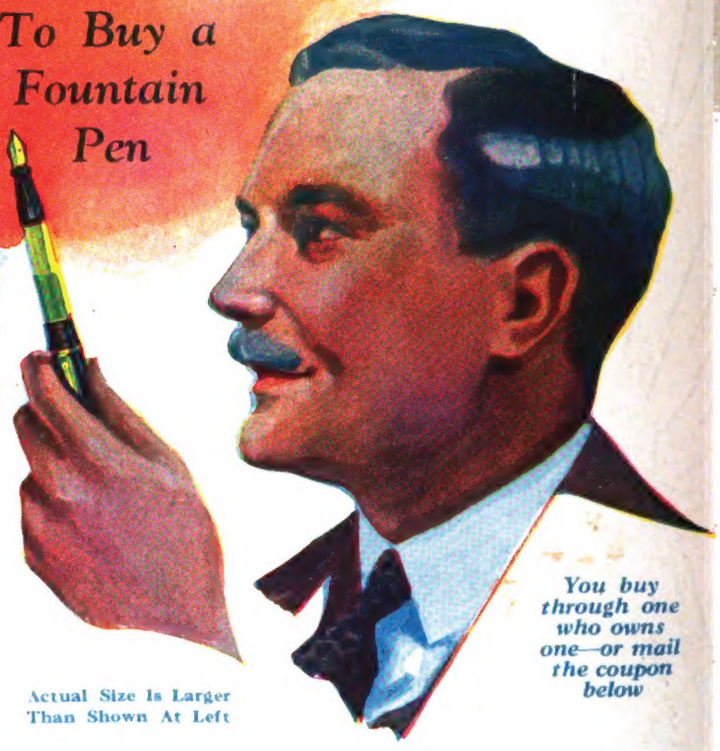

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